DOCUMENT RESUME

ED 236 349 CE 037 393

AUTHOR	Short, Sam
TITLE	Installation of Ceramic Tile: Residential Thin-Set Methods.
INSTITUTION	Oklahoma State Board of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.; Tile Council of America, Inc., Princeton, NJ.
PUB DATE	83
NOTE	641p.; Printed on colored paper.
AVAILABLE FROM	In-State: Curriculum and Instructional Materials Center, Oklahoma State Board of Vocational and Technical Education, 1515 West Sixth Avenue, Stillwater, OK 74074 ($12.00); Out-of-State: Tile Council of America, Inc., P.O. Box 326, Princeton, NJ 08540 (Write for price).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF03 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Behavioral Objectives; *Ceilings; *Construction Materials; Equipment Utilization; *Flooring; Guidelines; Hand Tools; Instructional Materials; Job Skills; Learning Activities; Measurement Techniques; Safety; Secondary Education; Teaching Methods; *Trade and Industrial Education
IDENTIFIERS	*Ceramic Tile; *Tile Occupations

ABSTRACT

This curriculum guide contains materials for use in teaching a course on residential thin-set methods of tile installation. Covered in the individual units are the following topics: the tile industry; basic math; tools; measurement; safety in tile setting; installation materials and guidelines for their use; floors; counter tops and backsplashes; wet area walls, floors, and ceilings; and renovation and repair. Each unit contains performance objectives, suggested activities, information sheets, transparency masters, assignment sheets, job sheets, tests, and answers to the tests and assignment sheets. (MN)

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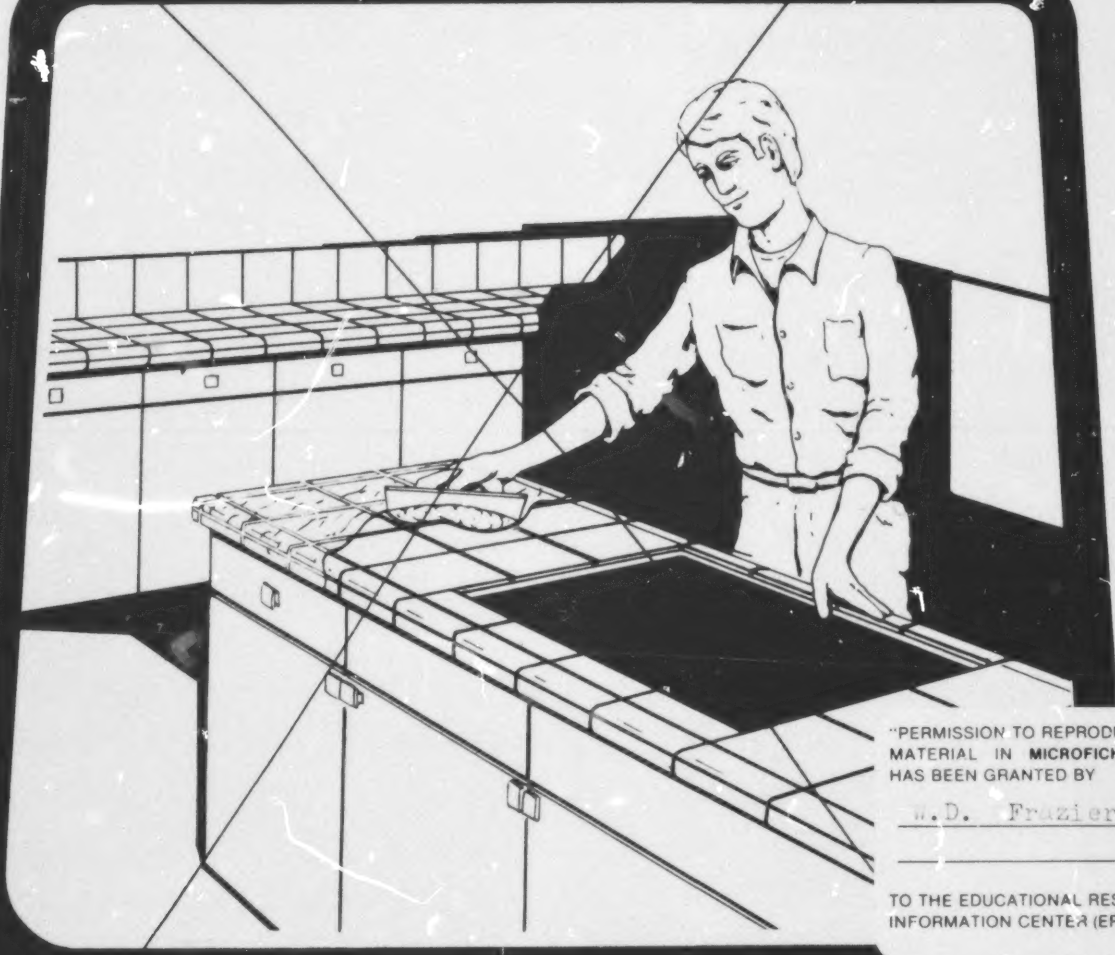
Installation of Ceramic Tile:

Residential Thin-Set Methods

OKLAHOMA STATE BOARD OF VOCATIONAL AND TECHNICAL EDUCATION



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Installation of Ceramic Tile:
Residential Thin-Set Methods

Written by
Sam Short, Curriculum Writer
Tile Council of America

Under the supervision of
Joyce Sawatzky, Assistant Coordinator
State Department of Vocational and Technical Education
Stillwater, Oklahoma

CE 037393

Developed as a cooperative project by the
Tile Council of America
Rudy H. Thornberry, Chairman, Development Advisory Committee
and
Oklahoma State Board of Vocational and Technical Education
Leslie Fisher, Chairman
Francis T. Tuttle, Director
Bob Patton, Coordinator, Curriculum and Instructional Materials Center

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Printed in the United States of America by the
State Department of Vocational and Technical Education
Stillwater, Oklahoma 74074

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INSTALLATION OF CERAMIC TILE: RESIDENTIAL THIN-SET METHODS

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FOREWORD

The use of ceramic tile in residential design and construction is steadily increasing because of tile's beauty, versatility, and durability. This growing demand, coupled with the rapid developments being made in materials and methods, makes it vitally important that the industry have a plentiful supply of trained, skilled craftspersons. This publication is a response to that need. The Tile Council of America and the Oklahoma State Department of Vocational and Technical Education have brought together representatives from all areas of the industry and from the field of education to combine their experience and expertise in the creation of these instructional materials.

Ceramic Tile Installation: Residential Thin-Set Methods was two years in development and represents the culmination of thousands of hours of research, writing, and review. The material will help to qualify the student in the job tasks most important in beginning work as a tile mechanic. The format reflects an organized, systematic approach to vocational instruction, employing the latest in educational technology innovations. However, this approach does not ignore the importance of the instructor's experience, personal methods, and additional materials in making the educational process complete. Instructors are encouraged to take advantage of the flexibility offered in these materials to adapt the training to meet the needs of students and local industry practices.

Dr. Francis T. Tuttle, Director
State Department of Vocational
and Technical Education

Dr. Vincent Fitzgerald, Executive Director
Tile Council of America

PREFACE

During my more than 40 years in the tile industry, I have seen a large number of poorly done installations. Most of the failures have been the result of improper installation methods and incorrect use of materials. However, the majority of these did not result from the tile setter being lazy or irresponsible; a lack of adequate training accounted for biggest part of the failures. Tile setting is a craft which requires skill and knowledge to produce the best, most appealing results. More than any other trade in the construction industry, tile setting is an art.

The rapid development of new materials such as expoxies and glass mesh mortar units further underlines the need for proper training. Materials in use today allow for faster, less expensive, longer lasting, and more versatile installations than were ever possible before. Yet the price of these advantages is that the materials require very precise standards and methods for their use to give maximum performance. This course is designed to instill in the student the skills and the desire to do a job well that such progress demands.

The material in this manual is performance oriented and is designed to help the student achieve measurable behavioral objectives. This approach to vocational education has proved to be successful. Additionally, a number of experts in the tile industry have served as an advisory committee to ensure the technical accuracy of this material. However, as with any craft, tile setting offers a wide variety of correct methods and techniques for accomplishing many of the tasks in the field. Often, we have tried to acknowledge other techniques even when we have chosen to emphasize one particular method, but it would be impossible to cover all of the possible techniques and still produce a manageable curriculum. Furthermore, our intent has been to prepare the student to enter the trade; on-the-job experience will allow the trained tile setter to choose and develop techniques which suit personal preferences while at the same time meeting professional standards. These instructional materials were designed to provide guidance to the student without being overly restrictive. When the instructor comes across techniques which are not locally preferred, the system is flexible enough to allow modification. I feel certain that this curriculum, coupled with the dedication only a concerned instructor can provide, will lead many students into rewarding and successful careers in the tile trade.

Sam Short, Curriculum Writer
Stillwater, Oklahoma

ACKNOWLEDGEMENTS

This publication is the result of the dedicated efforts and cooperation of many people who were willing to give their time, talents, and expertise to produce a quality product. Foremost among these were the members of the advisory committee whose skill, patience, and contributions through the revision process provided the required direction for reaching our goal.

Committee Members

Rudy H. Thornberry, Chairman
Florida Tile
Lakeland, Florida

W. R. (Rocky) Bonsal
W. R. Bonsal Company
Lilesville, North Carolina

Karl M. Claus
American Olean Tile Company
Lansdale, Pennsylvania

Paul Dinkel
Modulars, Inc.
Hamilton, Ohio

J. Vincent Fitzgerald
Tile Council of America
Princeton, New Jersey

Robert J. Kleinhans
Tile Council of America
Princeton, New Jersey

A. Robert Moore
Materials and Methods Standards Association
Palatine, Illinois

John (Bud) Morris
United Tile
Portland, Oregon

James (Sam) Paschal
Paschal Distributing Company
Tulsa, Oklahoma

Bob Patton, Coordinator
Curriculum and Instructional Materials Center
Stillwater, Oklahoma

Dave Yarborough
D and B Tile Distributors
Hollywood, Florida

Bob Young
Young Brothers, Inc.
Oklahoma City, Oklahoma

Special recognition is given to Paul Dinkel and Dave Yarborough for the many hours of additional time they spent in providing technical assistance during the drafting of the manuscript.

In addition to those represented on the committee, a number of organizations responsible for setting standards and specifications in the tile and related industries were gracious enough to provide assistance and to grant the use of their material in the production of this book. Further guidance was provided by several professional associations. These groups include:

American National Standards Institute

Ceramic Tile Distributors Association

Ceramic Tile Institute

Gypsum Association

Certainly we need to acknowledge the contributions made by the California State Department of Education and George N. Lavenberg with CTI, who pioneered instructional programs for tile setting and whose work served as extensive references in the development of this program.

I am grateful to the following companies for technical assistance and for the use of their publications, products, and services in the development of this book:

American Olean Tile Company, Landsdale, Pennsylvania; W. R. Bonsal Company, Lilesville, North Carolina; D and B Tile Distributors, Hollywood, Florida; Florida Tile, Lakeland, Florida; H. B. Fuller Company, Palatine, Illinois; Beno J. Gundlach Company, Belleville, Illinois; Hillyard Chemical Company, St. Joseph, Missouri; Modulars, Inc., Hamilton, Ohio; The Noble Company, Grand Haven, Michigan; Paschal Distributing Company, Tulsa, Oklahoma; Short's Carpet and Tile, Stillwater, Oklahoma; Young Brothers, Inc., Oklahoma City, Oklahoma.

The Oklahoma State Department of Vocational and Technical Education made this publication possible and provided invaluable assistance in ensuring the educational validity of the material and in the physical production of the book. Instrumental in implementing the project and guiding it to completion were Bob Patton, Coordinator, and Joyce Sawatzky, Assistant Coordinator, of the Curriculum and Instructional Materials Center. A number of members of their staff provided support, but I feel that special recognition should be given to Susan Walker, Terra McCluskey, and Robert Hilley for their editorial assistance and to Joan Henderson who did much of the photography, often under less than ideal conditions.

The Graphics Division spent many dedicated hours in the physical production of the book. Under the supervision of Jenny Fowler, the Communications Center typed the drafts and typeset the final copy. Much of this work was done by Dona Landreth, Rose Primeaux, Pat Tate, Lori White, and Crissie Wickham. The Art Department provided a number of original illustrations and laid out the graphics used in the book. Special recognition is given to Kim Hale and Nancy Hilley for their contributions. Finally, thanks to the staff of the Print Shop for the superb work done on final production. Noel Wilcoxson and his crew are to be commended.

Sam Short, Curriculum Writer
Stillwater, Oklahoma

USE OF THIS PUBLICATION

Instructional Units

Installation of Ceramic Tile: Residential Thin-Set Methods includes two instructional areas (sections). A standard format was established in 1970 for the development of instructional materials for all Oklahoma vocational teachers. This format includes eight basic components which form a unit of instruction: performance objectives, suggested activities for the teacher, information sheets, assignment sheets, job sheets, transparency masters, tests, and answers to tests and assignment sheets. Depending on the specific objectives, transparency masters, assignment sheets, and job sheets may or may not be included in the unit of instruction.

All of the unit components "zero in" on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching-learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help him or her determine the following.

A. Amount of material that can be covered in each class period
B. Skills which must be demonstrated
    1. Supplies and equipment needed
    2. Amount of practice needed
    3. Amount of class time needed for demonstrations
C. Supplementary materials, such as pamphlets and filmstrips, that must be ordered
D. Resource people who must be contacted

Performance Objectives (white pages)

Each unit of instruction is based on the performance needed for successful employment in an occupational area. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction, and specific objectives, stating the student performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important that teachers and students have a common understanding of the intent of the objectives. Following is a list of performance terms, their meanings, and behavioral synonyms which may have been used in this material.

A. Name — The individual supplies a name for objects, events, or people

Behavioral synonyms: Label, list, letter, record, reiterate, repeat, write

B. Identify — The individual selects a named, described, or pictured object by pointing to it, touching it, picking it up, or selecting it

Behavioral synonyms: Select, mark, match, choose, judge

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C. State a rule — The individual communicates a relationship or principle which could be used to solve problems or perform a task

D. Apply a rule — The individual supplies an answer to a problem by using a stated relationship or principle

Behavioral synonyms: Solve, calculate

E. Describe — The individual relates sufficient characteristics or properties of an object or event so that a second individual will be able to state what is being discussed

Behavioral synonyms: Define, discuss, interpret, recite, tell how, tell what happens when

F. Distinguish — The individual selects an object or event from two or more which are easily confused

Behavioral synonyms: Discriminate, differentiate

G. Order — The individual arranges three or more objects or events in a sequence based on a stated property

Behavioral synonyms: Arrange, sequence, list in order, classify, divide, isolate, sort

H. Construct — The individual makes a physical object, a verbal statement, or a drawing

(NOTE: Construct is used when the finished product or result is important.)

Behavioral synonyms: Draw, make, build, design, formulate, reproduce, transcribe, convert, put together, compile

I. Demonstrate — The individual performs several operations necessary to carry out a specified process

(NOTE: *Demonstrate* is used when it is desirable to watch the student perform a task, one of the highest levels of student performance.)

Behavioral synonyms: Show your work, show procedure, perform an experiment, perform the steps, operate, remove, replace, turn off/on, (dis)assemble, (dis)connect

The objectives should be provided for students and stressed throughout the teaching-learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Prepare for each unit by deciding how each objective can best be taught.

The objective sheet may be also used as a quick pretest to determine prior knowledge of students and to determine whether further study or activities are necessary. Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When changes in objectives are made, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion test items.

Suggested Activities (pink pages)

This component is included only in teacher material. The suggested activities page assists teachers during the preparation stage of the teaching-learning process by providing suggestions for delivery and/or presentation during the instructional process. Read the suggested activities before teaching the units so that supplemental materials can be obtained, audiovisual materials prepared, and outside resources contacted. Duties of the teacher will vary according to the particular unit.

The references that are listed are ones used in the development of each unit. They should be used by the teacher to supplement knowledge of the subject area or to help students with particular interests or occupational objectives in the area covered.

Information Sheet (green pages)

The information sheet provides "must know" content essential for meeting the cognitive (knowledge level) objectives of the unit. The information is written in a topical outline form and is keyed to the specific objectives.

Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. The information sheet may also be used for coordination activities and advisory committees.

Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide motivation for each unit.

Transparency Masters (white pages in teacher material and green in student material)

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheet. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion.

Assignment Sheets (brown pages)

Assignment sheets give students a chance at problem solving, self-assessment, and/or practical experience with the information. They assist students in the application of knowledges which are necessary prerequisites to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided, when appropriate, and can be used by the student and/or teacher for checking student progress.

Job Sheets (blue pages)

Job sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychometer skill. They describe a step-by-step procedure needed to complete each task or job. Diagrams, photographs, and illustrations are provided to assist students in achieving the skill.

A teacher should demonstrate to students the procedures outlined in each job sheet. Furthermore, the teacher needs to localize the job sheet according to the equipment and supplies available in the local lab or shop situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this vocational instruction.

Tests (yellow pages)

This component provides criterion-referenced evaluation of every objective listed in the unit of instruction. It is crucial to note that both paper/pencil and performance objectives must be evaluated.

The tests may be written or oral. It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of questions from the units covered may be used for final tests at the end of each term if desired. If objectives have been added, deleted, or modified, be sure to make the changes on the test.

The acceptable response on a unit test — 85 percent in most units — may be raised or lowered to fit the topic or students' ability levels. The percentage applies to the overall score, not to each question. The final unit grade should be obtained by using the paper/pencil score along with teacher evaluations of student demonstrations of the desired skills.

Answers to Test and Assignment Sheets (pink pages)

These components are designed to assist the teacher in evaluation of student performances.

Page Numbering

Each publication from the Curriculum and Instructional Materials Center is assigned a specific abbreviation. For example, *Installation of Ceramic Tile: Residential Thin-Set Methods* has been abbreviated CT. The units are then numbered consecutively within each section. An example of a page number is CT-1-A. Because CIMC publications are loose leaf, this system of page numbering was adopted so that pages from different manuals would not get mixed up.

Methods of Disseminating Material

Material may be given out a unit or page at a time to keep the material before the student always new. Some teachers ask students to furnish a three-ring binder for the units being studied. This is more convenient for taking the materials home to study. Upon its completion each unit is placed in a larger binder. The large binders may be purchased at cost from the CIMC. Some teachers store the materials by units in filing cabinets or boxes until needed. All the units may be given out at once if desired.

Student materials should be provided for each student for best results. Student materials contain everything but the test answers, answers to assignment sheets, and suggested activities. All tests are collated at back of student material and should be removed and stored until needed. Students should be allowed to take their materials home at the end of the year.

Teaching Methods

It is a challenge to keep students motivated. Supplement the objectives by providing the "why," personal experiences, and current information. Prepare for each unit by deciding how each objective can best be taught. Allow students to become involved in preparing and planning.

INTRODUCTION TO TILE INDUSTRY
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to make a decision to seek training or employment as a tile setter or tile mechanic. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms related to employment in the tile industry.
2. Select from a list key facts that affect tile industry.
3. Name job opportunities for tile setters.
4. Describe advantages and disadvantages for occupation of tile setter.
5. Select from a list characteristics of a good tile setter.
6. Select from a list major skills in tile setter training.
7. Name job benefits associated with the tile industry.
8. Name organizations that affect ceramic tile industry.
9. Complete job application form.
10. Practice interview questions.
11. Interview a tile setter or an employer of tile setters.

INTRODUCTION TO TILE INDUSTRY
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials planned to supplement unit.

      (NOTE: Films, brochures, and other references will be particularly helpful to introduce students to the tile industry.)

   B. Provide students with objective sheet.

   C. Discuss unit and specific objectives.

   D. Provide students with information and assignment sheets.

   E. Discuss information and assignment sheets.

   F. Secure informational packets from trade organizations to assist in teaching Objective 8.

   G. Assist students in making arrangements to complete Assignment Sheet #3.

   H. Invite local people in tile industry to discuss realities of employment.

   I. Allow students to practice interview questions by having adults role play prospective employers.

   J. Give test after students have completed unit and assignments.

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment sheets

      1. Assignment Sheet #1--Complete Job Application Form

      2. Assignment Sheet #2--Practice Interview Questions

      3. Assignment Sheet #3--Interview a Tile Setter or an Employer of Tile Setters

   E. Answers to assignment sheets

   F. Test

   G. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

A. Fitzgerald, J. V. "Profile of the Ceramic Tile Industry." *Ceramic Industry,* (September, 1978), pp. 46-48.

B. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator: Vol. I.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center and Associated General Contractors of America, Inc., 1981.

INTRODUCTION TO TILE INDUSTRY
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Tile--Ceramic surfacing unit, usually relatively thin in relation to facial area; made from clay or a mixture of clay and other ceramic materials (called the body) having either a glazed or unglazed face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristics

(NOTE: See ANSI A137-1.)

B. Tile mechanic/setter--Person trained or experienced in installing ceramic tile

(NOTE: Some tile setters work by the hour while others work by the amount of tile installed. Also, some tile setters are union affiliated, while others work independently of unions.)

C. Contractor--Person or company whose business is doing work for a stipulated sum

D. Subcontractor--Person or company that assumes, by secondary contract, some or all of the obligations of the original contractor

II. Key facts that affect tile industry

A. Use of ceramic tile in building projects increases yearly

(NOTE: It is estimated that American consumption of ceramic tile will reach one billion dollars by 1990.)

EXAMPLES:
1. Many plans for new homes specify use of ceramic tile.
2. Many homeowners select ceramic tile for use in remodeling older rooms or in adding new rooms; in fact, the demand for tile work in remodeling should surpass usage in new construction.
3. More designers and builders are specifying use of ceramic tile in a wide variety of commercial buildings such as apartments, restaurants, and shopping centers.
4. Ceramic tile is one of the best installations in passive solar installations

B. Manufacturers of ceramic tile are constantly creating new designs,patterns, textures and colors to attract potential buyers

C. There is a demand for well-trained tile mechanics/setters

(NOTE: The training of good tile setters has always lagged.)

INFORMATION SHEET

- D. More training programs for tile setters are beginning to appear
- E. Better tile-setting tools and materials are being produced
- F. Well-trained tile setters have better opportunity to secure special jobs

III. Job opportunities for tile setters (Assignment Sheet #3)

- A. Jobs with independent and union-affiliated contractors
- B. Independent contracting

  (NOTE: Most independent contractors in the tile industry began as tile setters.)
- C. Affiliation with tile-selling businesses
- D. Employment by large companies or contractors that hire independent tile setters
- E. Subcontracting tile work with building contractors
- F. Contacting tile distributors to get on their lists as a subcontractor

IV. Advantages and disadvantages for occupation of tile setter (Assignment Sheet #3)

- A. Advantages
  1. Most work is inside
  2. Work is not subject to seasonal changes
  3. Good salary

     (NOTE: As skill increases, wages often climb.)
  4. Clean working environment
- B. Disadvantages
  1. Some travel away from home
  2. Some people can be hard to please

V. Characteristics of a good tile setter (Assignment Sheets #1 and #2)

- A. Must be willing to work physically
- B. Gets along well with employer
- C. Has a good personality

INFORMATION SHEET

D. Can take and follow instructions

E. Takes pride in work and is one of the most highly skilled workers in the construction industry today

F. Is willing to learn new techniques and skills

G. Is willing to take constructive criticism and make corrections

H. Is polite to all people

(NOTE: A tile setter is especially polite to the person or persons for whom the job is being done. Politeness creates good relations between employer, customer, and tile setter.)

I. Asks self constantly, "If you do not have time to do the job right the first time, how do you expect to have time to go back and redo it?"

J. Is neatly dressed and groomed

K. Enjoys work

L. Is reliable

M. Shows initiative and is a self-starter

VI. Major skills in tile setter training

A. Handling tools (especially hand tools)

B. Operating tools safely

C. Keeping tools clean and in good order

D. Measuring accurately

E. Laying out job

F. Evaluating materials used in tile installations for their intended purposes and uses

G. Installing ceramic tile

H. Repairing existing installations

I. Removing existing work and replacing with new

VII. Job benefits associated with the tile industry (Assignment Sheet #2)

A. Good take-home pay

B. Insurance

C. Unemployment compensation

INFORMATION SHEET

- D. Travel insurance while on job
- E. Paid vacations
- F. Sick leave with pay
- G. Expenses paid for out-of-town jobs
- H. Self-employment opportunities

VIII. Organizations that affect ceramic tile industry

- A. Tile Council of America, Inc.
- B. Ceramic Tile Institute
- C. Ceramic Tile Institute of America
- D. Materials and Methods Standards Association
- E. Ceramic Tile Distributors of America
- F. Associated Tile Contractors of Southern California
- G. Gypsum Association
- H. International Union of Bricklayers and Allied Craftsmen
- I. Metal Lath/Steel Framing Association
- J. Northern California Ceramic Tile Industry
- K. Southern Tile, Terrazzo,and Marble Contractors Association
- L. The Adhesive and Sealant Council
- M. Tile Contractors Association of America, Inc.
- N. Western States Ceramic Tile Contractors Association
- O. American National Standards Institute
- P. National Home Builders Association
- Q. Associated General Contractors of America
- R. Associated Builders and Contractors
- S. Building Officials and Code Administrators International, Inc.
- T. International Conference of Building Officials
- U. Southern Building Code Congress International, Inc.

INTRODUCTION TO TILE INDUSTRY
UNIT I

ASSIGNMENT SHEET #1--COMPLETE JOB APPLICATION FORM

NAME ____ SCORE ____________

There are many industries that hire tile setters, just as there are many ways to find tile setter jobs. Many carpet and resilient floor shops hire tile setters. Ceramic tile distributors are often another source of employment. Asking at different businesses that deal in ceramic tile is a good way to find out how they hire tile setters. And, more often than not, one tile setter may gain job leads from another tile setter.

PART I

A. One way to look for a job is to read the classified ads. Using a local or metropolitan Sunday newspaper, clip all the ads associated with tile work. Use the space below and additional sheets of paper, if necessary, to attach the want ads that you find.

B. A lot of tile-related businesses do not advertise for tile setters in the newspapers. Why do you think this is true?

____

____

____

ASSIGNMENT SHEET #1

PART II

Despite a source that may lead you to a job opening, you may be required to complete an application form. Completing an employment application accurately and neatly could make the difference in getting the job.

Complete the following application form, using the guidelines below and information about yourself.

(NOTE: Although each business uses its own form, general rules of preparation apply to any form.)

A. Be prepared

   1. Take a good pen

   2. Take copies of resume

B. Look over entire form before starting to write; do not hurry

C. Follow directions

   1. Note whether information is to be printed or written

   2. Carry out all directions

D. Write clearly, neatly, and legibly

E. Answer briefly

F. Be honest

G. Answer all questions

   (NOTE: If questions do not apply to you, write NOT APPLICABLE or N/A in the space to show that you did not overlook the question.)

H. Include complete information

I. Recheck application when finished

J. Avoid cross-outs and erasure marks

K. Use the word *open* for questions about minimum salary since most employers pay standardized rates and will not negotiate this

CT - 11-A

APPLICATION FOR EMPLOYMENT

DATE ____________________

Name ____ SS No. ____________________
(Last) (First) (Middle)

Present Address ____ Telephone No. ____________________
Street Address City

Phone where you can be reached if not at above number Telephone No. ____________________

Are there any periods during the year when you will not be available for work?
Yes ______ No ______ When? ______

What is the earliest date you will be available to start work? ____________

Are you licensed or certified by any trade or profession? Yes ______ No ______
Kind of license? ____________

Have you worked for this company before?
Yes ______ No ______ When? ______

How did you hear of employment opportunities at this company? ____________
____

If part-time, what hours can you work? ____
____

Position desired: First preference will be given first consideration
1. ____________________
2. ____________________
3. ____________________

Is there a minimum salary acceptable?
Yes ____ No ____ If yes, what amount? ______

How long do you wish employment?
Years ________ Months ________

I will accept:
Full-time ____ Part-time ____ Temporary ____
(6 mos. or less)

Are you willing to attend conferences and workshops to improve your professional skills? ____________

How do you feel you are qualified for the position(s) applied for?
____
____
____
____

EDUCATION: List in order the educational institutions you have attended if applicable.

Dates		Name of Institution	Major & Minor Courses Pursued	Degree or Certificate
From	To			
High School				
College or Univ.				
Vocational, Technical, or Trade Schools				

12-A

May we contact your present employer for references? ________

Employer ____________________ Address ____________________
(Present or Most Recent) Street City State

Phone ____________________

Name and title of supervisor ____________________ From Month ______ Year ______

Your job and description of duties ____________________ To Month ______ Year ______

____________________ Pay $ ______ Per ______

Reason for terminating this employment ____________________

Employer ____________________ Address ____________________
Street City State

Phone ____________________

Name and title of supervisor ____________________ From Month ______ Year ______

Your job and description of duties ____________________ To Month ______ Year ______

____________________ Pay $ ______ Per ______

Reason for terminating this employment ____________________

Employer ____________________ Address ____________________
Street City State

Phone ____________________

Name and title of supervisor ____________________ From Month ______ Year ______

Your job and description of duties ____________________ To Month ______ Year ______

____________________ Pay $ ______ Per ______

Reason for terminating this employment ____________________

REFERENCES

1. ____________________
Name Address Phone

2. ____________________
Name Address Phone

3. ____________________
Name Address Phone

4. ____________________
Name Address Phone

5. ____________________
Name Address Phone

The above information is requested to become aquainted with your qualifications and IS NOT an offer of employment.

I certify that all of the information stated in this application is true to the best of my knowledge and belief, and I authorize you to refer to any former employers or others to verify the statements made.

This company does not discriminate on the basis of race, creed, color, national origin, sex, age, veteran status, qualified handicap, or disability.

INTRODUCTION TO TILE INDUSTRY
UNIT I

ASSIGNMENT SHEET #2--PRACTICE INTERVIEW QUESTIONS

NAME ______________________________ SCORE __________

The following are some questions which might be asked when applying for a job. Keep the assignment sheet to review before going to an interview.

(NOTE: Questions about your personal life may not legally be asked. In fact, it is illegal for an employer to ask your maiden name or your father's surname if you are a female applicant, your marital status, who lives with you, the church you attend or the name of your spiritual leader, how many children you have, their ages, or who will care for them while you are at work, whether you own or rent your residence, whether you have ever had your wages garnisheed, and whether you have ever been arrested. However, many interviewers, particularly in smaller businesses, may ask such questions. Whether or not you choose to answer the questions depends on how badly you want the job. Some interviewers do not have to ask these questions; they just automatically arise during the conversation.)

A. Why did you leave your previous job?

____

____

B. What did you like best about your job?

____

____

C. Are you in good health?

____

____

D. Do you intend to make this work your career?

____

____

E. What are some of your special abilities?

____

____

F. Which tools are you familiar with and which can you use?

____

____

ASSIGNMENT SHEET #2

G. How would you rate your training for this job? Very good? Fair?

H. What personal characteristics do you think are needed to succeed in this vocation?

I. At what salary do you expect to start?

J. How could you contribute to our organization?

K. Why should we hire you?

L. Tell us about your family and any plans for marriage or further education.

(NOTE: REMEMBER--Legally, you do not have to answer this question. However, it is a good idea to have an answer.)

M. Have you applied for any other jobs?

N. Do you have any military obligations to fulfill?

ASSIGNMENT SHEET #2

O. Would you be able to work Saturdays and Sundays or at night in extreme cases?

P. Does criticism disturb you?

Q. Define cooperation.

R. How do you feel about overtime?

REMEMBER: You never get a second chance to make a good first impression. GETTING A JOB IS A JOB.

INTRODUCTION TO TILE INDUSTRY
UNIT I

ASSIGNMENT SHEET #3--INTERVIEW A TILE SETTER OR AN EMPLOYER OF TILE SETTERS

NAME ______________________________ SCORE __________________

Interviewing someone who is working in the trade will help you to determine if this is the kind of work you want to do. Take this assignment sheet with you during the interview and take notes. Ask the following questions.

A. What made you decide to become a tile setter?

____

____

B. Are you happy with this kind of work?

____

____

C. What do you do on your job?

____

____

D. What are some of the strong points of being employed in the tile industry?

____

____

E. Would you recommend this type of job to a young person?

____

____

F. What type of training is necessary?

____

____

G. What kind of future does your job have?

____

____

ASSIGNMENT SHEET #3

H. What tools do I need to start to work?

I. Assume that you have just graduated from a vocational-technical course in tile setting. What kind of pay could you expect to earn immediately?

J. Does your job permit full-year inside work?

K. What kind of car is needed, if any?

L. Any other questions you *asked* and the responses.

INTRODUCTION TO TILE INDUSTRY
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1--Evaluated to the satisfaction of the instructor

Assignment Sheet #2--Evaluated to the satisfaction of the instructor

Assignment Sheet #3--Evaluated to the satisfaction of the instructor

INTRODUCTION TO TILE INDUSTRY
UNIT I

TEST

NAME ______________________________ SCORE __________

1. Match to their correct definitions terms related to employment in the tile industry. Write the correct numbers in the blanks.

_____ a. Ceramic surfacing unit, usually relatively thin in relation to facial area; made from clay or a mixture of clay and other ceramic materials (called the body); having either a glazed or unglazed face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristics

_____ b. Person trained and experienced in installing ceramic tile

_____ c. Person or company whose business is doing work for a stipulated sum

_____ d. Person or company that assumes, by secondary contract, some or all of the obligations of the original contractor

1. Subcontractor
2. Tile
3. Tile mechanic/setter
4. Contractor

2. Select from the following list key facts that affect tile industry. Write an "X" in the blank before each correct answer.

_____ a. Ceramic tile is a fired clay product used for covering surfaces in residential buildings only

_____ b. Use of ceramic tile in building projects increases yearly

_____ c. Manufacturers of ceramic tile are constantly creating new designs, patterns, and colors to attract potential buyers

_____ d. Commercial designers and builders do not recommend tile for use in apartments and buildings

_____ e. Ceramic tile is seldom used in remodeling or renovation

_____ f. There is a demand for well-trained tile mechanic/setters

_____ g. More training programs for tile setters are beginning to appear

_____ h. There is little demand for tile setters

_____ i. Better tile-setting tools and materials are being produced

_____ j. Well-trained tile setters have better opportunity to secure special jobs

TEST

3. Name four job opportunities for tile setters.

   a. ______

   b. ______

   c. ______

   d. ______

4. Describe advantages and disadvantages for occupation of tile setter.

   a. Advantages-- ______

   b. Disadvantages-- ______

5. Select from the following list characteristics of a good tile setter. Write an "X" in the blank before each correct answer.

   ______a. Must be willing to work physically

   ______b. Is reliable

   ______c. Gets along well with employer

   ______d. Is willing to take criticism and make corrections

   ______e. Refuses to follow employer's instructions

   ______f. Shows initiative and is a self-starter

   ______g. Can take and follow instructions

   ______h. Is neatly dressed and groomed

   ______i. Leaves tools littering job site

   ______j. Is willing to learn new techniques and skills

   ______k. Has a good personality

TEST

_____l. Is suspicious of new techniques or skills

_____m. Is polite to all people

_____n. Occasionally argues with co-workers and employer

_____o. Rushes through job, planning to redo any mistakes later

_____p. Asks self constantly, "If you do not have time to do the job right the first time, how do you expect to have time to go back and redo it?"

_____q. Has a nonchalant attitude and wears only very old, torn clothing

_____r. Takes pride in work

_____s. Enjoys work

6. Select from the following list major skills in tile setter training. Write an "X" in the blank before each correct answer.

_____a. Handling tools (especially hand tools)

_____b. Estimating amount of tile and trim needed

_____c. Measuring accurately

_____d. Keeping tools clean and in good order

_____e. Ordering materials

_____f. Operating tools safely

_____g. Deciding brand of tile owner must use

_____h. Developing tile glazes

_____i. Picking up materials at distributor

_____j. Firing ceramic tiles

_____k. Laying out job

_____l. Installing ceramic tile

_____m. Removing existing work and replacing with new

_____n. Evaluating materials used in tile installations for their intended purposes and uses

_____o. Installing plumbing fixtures when necessary

_____p. Repairing existing installations

TEST

7. Name six job benefits associated with the tile industry.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

g. ____________________

8. Name six organizations that affect the ceramic tile industry.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

(NOTE: Test questions 9-11 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

9. Complete job application form.

10. Practice interview questions.

11. Interview a tile setter or an employer of tile setters.

INTRODUCTION TO TILE INDUSTRY
UNIT I

ANSWERS TO TEST

1. a. 2
   b. 3
   c. 4
   d. 1
2. b, c, f, g, i, j
3. Answer should include any four of the following
   a. Jobs with independent and union-affiliated contractors
   b. Independent contracting
   c. Affiliation with tile-selling businesses
   d. Employment by large companies or contractors that hire independent tile setters
   e. Subcontracting tile work with building contractors
   f. Contacting tile distributors to get on their lists as a subcontractor
4. Descriptions should include the following
   a. Advantages
      1) Most work is inside
      2) Work is not subject to seasonal changes
      3) Good salary
      4) Clean working environment
   b. Disadvantages
      1) Some travel away from home
      2) Some people can be hard to please
5. a, b, c, d, f, g, h, j, k, m, p, r, s
6. a, b, c, d, f, k, l, m, n, p

ANSWERS TO TEST

7. Answer should include any six of the following
   - a. Good take-home pay
   - b. Insurance
   - c. Unemployment compensation
   - d. Travel insurance while on job
   - e. Paid vacations
   - f. Sick leave with pay
   - g. Expenses paid for out-of-town jobs
   - h. Self-employment opportunities
8. Answer should include any six of the following
   - a. Tile Council of America, Inc.
   - b. Ceramic Tile Institute
   - c. Ceramic Tile Institute of America
   - d. Materials and Methods Standards Association
   - e. Ceramic Tile Distributors of America
   - f. Associated Tile Contractors of Southern California
   - g. Gypsum Association
   - h. International Union of Bricklayers and Allied Craftsmen
   - i. Metal Lath/Steel Framing Association
   - j. Northern California Ceramic Tile Industry
   - k. Southern Tile, Terrazzo, and Marble Contractors Association
   - l. The Adhesive and Sealant Council
   - m. Tile Contractors Association of America, Inc.
   - n. Western States Ceramic Tile Contractors Association
   - o. American National Standards Institute
   - p. National Home Builders Association
   - q. Associated General Contractors of America

ANSWERS TO TEST

- r. Associated Builders and Contractors
- s. Building Officials and Code Administrators International, Inc.
- t. International Conference of Building Officials
- u. Southern Building Code Congress International, Inc.

9. Evaluated to the satisfaction of the instructor
10. Evaluated to the satisfaction of the instructor
11. Evaluated to the satisfaction of the instructor

BASIC MATH
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to use basic math to solve tilesetting problems. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to

1. Match terms associated with basic math to their correct definitions.
2. Select reasons that math is important to the tile setter.
3. Label math problems with their correct math function terms.
4. Match symbols used in math problems to their correct definitions.
5. Solve addition problems.
6. Solve subtraction problems.
7. Solve multiplication problems.
8. Solve division problems.
9. Distinguish among types of fractions.
10. Convert numbers and improper fractions.
11. Reduce fractions to lowest terms.
12. Find lowest common denominators.
13. Add fractions.
14. Subtract fractions.
15. Write the place value of decimals.
16. Round off decimals.
17. Add decimals.
18. Subtract decimals.

OBJECTIVE SHEET

19. Multiply decimals.

20. Divide whole numbers and decimals, using decimals.

21. Convert fractions and decimals.

22. Convert decimals and fractions to percentages.

23. Convert percentages to fractions and decimals.

24. Solve percentage problems.

BASIC MATH
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Make transparencies.

  B. Use a pretest to assess students' strengths and weaknesses in math.

  C. Provide students with objective sheet.

  D. Discuss unit and specific objectives.

  E. Provide students with information and assignment sheets.

  F. Discuss information and assignment sheets.

  G. Omit specific assignments if student(s) show proficiency.

  H. Give test after students complete unit and assignments.

  (NOTE: It is recommended that this test be given in parts, such as the math processes, fractions, and decimals.)

II. Instructional materials

  A. Objective sheet

  B. Suggested activities

  C. Information sheet

  D. Transparency masters

    1. TM #1 — Math Function Terms

    2. TM #2 — Decimal Equivalents

  E. Assignment sheets

    1. Assignment Sheet #1 — Solve One-Digit Addition Problems

    2. Assignment Sheet #2 — Solve Two-Digit Addition Problems

    3. Assignment Sheet #3 — Solve Three-Digit Addition Problems

    4. Assignment Sheet #4 — Solve One-Digit Subtraction Problems

    5. Assignment Sheet #5 — Solve Two-, Three-, and Four-Digit Subtraction Problems

    6. Assignment Sheet #6 — Solve One-Digit Multiplication Problems

SUGGESTED ACTIVITIES

7. Assignment Sheet #7 — Solve Multiplication Problems with One-Digit Multipliers
8. Assignment Sheet #8 — Solve Multiplication Problems with Two- and Three-Digit Multipliers
9. Assignment Sheet #9 — Solve Division Problems with One-Digit Divisors
10. Assignment Sheet #10 — Solve Long-Division Problems
11. Assignment Sheet #11 — Work with Fractions
12. Assignment Sheet #12 — Use Fractions and Numbers
13. Assignment Sheet #13 — Reduce Fractions to Lowest Terms
14. Assignment Sheet #14 — Find Common Denominators
15. Assignment Sheet #15 — Add Fractions
16. Assignment Sheet #16 — Subtract Fractions
17. Assignment Sheet #17 — Round Off Decimals
18. Assignment Sheet #18 — Solve Addition Problems with Decimals
19. Assignment Sheet #19 — Solve Subtraction Problems with Decimals
20. Assignment Sheet #20 — Solve Multiplication Problems with Decimals
21. Assignment Sheet #21 — Solve Division Problems with Decimals
22. Assignment Sheet #22 — Convert Fractions and Decimals
23. Assignment Sheet #23 — Write Decimals and Fractions as Percentages
24. Assignment Sheet #24 — Write Percentages as Fractions and Decimals
25. Assignment Sheet #25 — Solve Percentage Problems
26. Assignment Sheet #26 — Find Percentages of Whole Numbers

F. Answers to Assignment Sheets

G. Test

H. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

A. *Course in Tilesetting*. Jackson, Mississippi: Southern Tile, Terazzo, and Marble Contractors Association, 1964.

B. Gossage, Loyce G., and Briggs, Milton. *Basic Mathematics Review*. Cincinnati, Ohio: South-Western Publishing Co., 1969.

C. Hendrix, Laborn J., "Bud." *Millwright Instructional Materials*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center and Associated General Contractors of America, 1980.

D. Morrison, Phyllis. *Basic Math Skills*. New York: McGraw-Hill Book Company, 1972.

BASIC MATH
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Digit — Any one of the ten symbols, 0 to 9, by which all numbers may be expressed

B. Subtraction — Opposite (inverse) operation of addition

C. Multiplication — An abbreviated process of adding an integer to itself a specified number of times

EXAMPLE: $6 \times 3 = 18$ or $6 + 6 + 6 = 18$

D. Integer — Positive or negative whole number

E. Division — Opposite (inverse) operation of multiplication

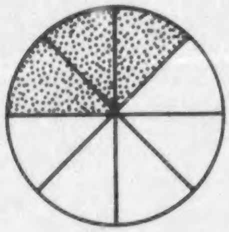
EXAMPLE: $16 \div 2 = 8$

F. Problem — Mathematical proposition

G. Calculate — To solve by mathematical process

H. Fraction — Part of a whole; represents one or more equal parts of a unit

EXAMPLE: If the unit is divided into eight equal parts, then each part is one-eighth ($^1/_8$) of the unit; the fraction three-eights ($^3/_8$) means three of the parts, as shown in the shaded portion of the figure below.



INFORMATION SHEET

- I. Frame (√) — Bracket used to enclose dividend in a division problem
- J. Caret (∧) — Mark made to indicate where something is to be inserted
- K. Decimals — Fractions based on the number 10; not written as common fractions

  EXAMPLES: $1/10 = 0.1$

  $6/100 = 0.06$

  $3/1000 = 0.003$

- L. Perimeter — Outer limits or boundary
- M. Percent — One part in a hundred; reckoned on the basis of a whole divided into one hundred parts
- N. Unit — First integer

II. Reasons math is important to tile setter

- A. To plumb and square work
- B. To solve problems when figuring the layout and backing board spacing
- C. To keep a record of materials used on job
- D. To figure total costs when unit costs are known
- E. To figure total tile amounts when unit amounts are known

III. Math function terms (Transparency #1)

- A. Addition
  - 1. Addend
  - 2. Sum or total
- B. Subtraction
  - 1. Minuend
  - 2. Subtrahend
  - 3. Difference

INFORMATION SHEET

C. Multiplication

    1. Multiplicand
    2. Multiplier
    3. Partial product
    4. Product

D. Division

    1. Divisor
    2. Dividend
    3. Quotient
    4. Remainder

IV. Symbols used in math problems

	Name of Symbol	Symbol(s)
A.	Addition	+
B.	Subtraction	−
C.	Division	÷
D.	Multiplication	×
E.	Equal	=
F.	Decimal	.
G.	Percent	%
H.	Caret	∧

V. Addition (Assignment Sheets #1, #2, and #3)

A. Write units under units, tens under tens, and so on

B. Begin adding the far right column

INFORMATION SHEET

C. If sum of any column is ten or more, write last figure and carry other figure

EXAMPLE:

$$\begin{array}{r} 1420 \\ 15 \\ +\ 123 \\ \hline 1558 \end{array} \qquad \begin{array}{r} 1 \\ 1352 \\ 17 \\ +\ 260 \\ \hline 1629 \end{array}$$

Carried figure

VI. Subtraction (Assignment Sheets #4 and #5)

A. Write units under units, tens under tens, and so on

(NOTE: When subtracting, subtrahend almost always will be smaller than top figure.)

B. Begin with the first column on the far right, and move to the left

EXAMPLE:

$$\begin{array}{r} 784 \\ -\ 431 \\ \hline 353 \end{array}$$

C. If digit in subtrahend is larger than digit in minuend, borrow from the column to the left; increase the minuend digit by 10

EXAMPLES:

1.

$$\begin{array}{r} 123 \\ -\ 91 \\ \hline 2 \end{array}$$

Subtract the first column (3 − 1 = 2)

$$\begin{array}{r} \cancel{1}23 \\ -\ 91 \\ \hline 32 \end{array}$$

Borrow from the left column to subtract the second column (12 − 9 = 3)

$$\begin{array}{r} \cancel{1}23 \\ -\ 91 \\ \hline 32 \end{array}$$

Nothing remains in the left column to subtract

2.

$$\begin{array}{r} 2\cancel{4}1 \\ -\ 186 \\ \hline 5 \end{array}$$

Borrow from the second column to subtract the first column (11 − 6 = 5)

INFORMATION SHEET

$$\begin{array}{r} 3\\ 2\cancel{4}1\\ -\underline{186}\\ 55 \end{array}$$

Borrow from the left column to subtract the second column (13 − 8 = 5)

$$\begin{array}{r} 13\\ \cancel{2}\cancel{4}1\\ -\underline{186}\\ 55 \end{array}$$

Subtract the left column (1 − 1 = 0)

3.

$$\begin{array}{r} 906\\ -\underline{318}\\ 8 \end{array}$$

Borrow from the second column to subtract the first (16 − 8 = 8)

(NOTE: Because there is nothing to borrow from the second column, you must first borrow from the left column. This makes the middle column 10 instead of 0. You can then borrow for the first column.)

$$\begin{array}{r} 89\\ \cancel{9}\cancel{0}6\\ -\underline{318}\\ 88 \end{array}$$

Subtract the second column (9 − 1 = 8)

$$\begin{array}{r} 89\\ \cancel{9}\cancel{0}6\\ -\underline{318}\\ 588 \end{array}$$

Subtract the left column (8 − 3 = 5)

D. Check your subtraction by adding the difference to the subtrahend

EXAMPLE:

$$\begin{array}{rcr} & & \text{Check}\\ 271 & & 164\\ -\underline{\ 164} & & +\underline{\ 107}\\ 107 & & 271 \end{array}$$

VII. Multiplication (Assignment Sheets #6 — #8)

A. Write the larger factor (multiplicand) above the smaller factor (multiplier)

(NOTE: Write units under units, tens under tens, and so on.)

B. If multiplier has only one figure, multiply this figure by each number in multiplicand, starting from right and working in order to the left

1. Multiply unit figure of top factor by multiplier

INFORMATION SHEET

2. Write the results and carry over the tens

EXAMPLE:

$$\begin{array}{r l} 1 & \text{Carried figure} \\ 53 & \\ \times\ 4 & \\ \hline 2 & \end{array}$$

3. Multiply the second figure of multiplicand by the multiplier and add carried number

EXAMPLE:

$$\begin{array}{r} 1 \\ 53 \\ \times\ \ 4 \\ \hline 212 \end{array}$$

4. Continue working to the left until all figures in multiplicand have been multiplied

C. If multiplier has more than one figure, find partial products first

1. Multiply each number in multiplicand by first figure on the far right of multiplier; record partial product

EXAMPLE:

$$\begin{array}{r l} 174 & \\ \times\ 42 & \\ \hline 348 & \text{Partial product} \end{array}$$

2. Multiply each number in multiplicand by second figure from right in multiplier; record partial product

EXAMPLE:

$$\begin{array}{r l} 174 & \\ \times\ \ 42 & \\ \hline 348 & \text{Partial product} \\ 696 & \text{Partial product} \end{array}$$

(NOTE: Each partial product is written so that the last digit is aligned under the digit of the multiplier which produced it.)

3. Continue as above until each figure in the multiplier has multiplied the top figures

4. Add the partial products

EXAMPLE:

$$\begin{array}{r l} 174 & \\ \times\ \ 42 & \\ \hline 348 & \\ +\ 696 & \\ \hline 7308 & \text{Product} \end{array}$$

INFORMATION SHEET

VIII. Division (Assignment Sheets #9 and #10)

A. Write inside the frame the number to be divided (dividend); write the number you are dividing by (divisor) on the outside of frame

EXAMPLE: 1974 ÷ 6 $6\overline{)1974}$

B. Determine how many times number on outside will go into the first number on the inside; if it will not, determine how many times it will go into first two numbers and write this figure on top of frame above the right digit of the number it went into

(NOTE: Continue trying to divide the dividend by the divisor until a set of digits can be divided. This set will contain the same number of digits or one more digit than the divisor.)

EXAMPLE: 1974 ÷ 6

$$\begin{array}{r}
3\\
6\overline{)1974}
\end{array}$$

C. Multiply number on outside of frame by number on top; write results under the figures the outside number went into, and subtract these figures

EXAMPLES: 1974 ÷ 6

$$\begin{array}{r}
3\\
6\overline{)1974}\\
\underline{18}\\
1
\end{array}$$

D. Bring down the next figure; determine how many times the number on outside of frame will go into bottom figure, and write it above the figure that was brought down

EXAMPLES: 1974 ÷ 6

$$\begin{array}{r}
32\\
6\overline{)1974}\\
\underline{18}\\
17
\end{array}$$

E. Multiply number on outside of frame by the last number you wrote on top; write results under the figures the outside number went into, and subtract these figures

EXAMPLES: 1974 ÷ 6

$$\begin{array}{r}
32\\
6\overline{)1974}\\
\underline{18}\\
17\\
\underline{12}\\
5
\end{array}$$

INFORMATION SHEET

F. Bring down next figure; determine how many times number on outside of frame will go into it and write it above figure that was brought down; multiply times the number on outside and write the results

EXAMPLES: 1974 ÷ 6

$$\begin{array}{r} 329 \\ 6\overline{)1974} \\ \underline{18} \\ 17 \\ \underline{12} \\ 54 \\ \underline{54} \end{array}$$

G. Continue the same process until all numbers in the dividend are used

H. Write the difference between the last two figures under the dividend as a remainder

EXAMPLES: 1971 ÷ 6

$$\begin{array}{r} 328 \\ 6\overline{)1971} \\ \underline{18} \\ 17 \\ \underline{12} \\ 51 \\ \underline{48} \\ 3 \end{array}$$

1971 ÷ 6 = 328, R3

I. To check your answer, multiply the quotient by the divisor and add the remainder, if any

(NOTE: This should give you the dividend.)

EXAMPLE: 1971 ÷ 6 = 328, R3

$$\begin{array}{r} 328 \\ \underline{\times \quad 6} \\ 1968 \\ \underline{+ \quad 3} \\ 1971 \end{array}$$

IX. Types of fractions (Assignment Sheets #11 and #12)

A. Single fractions

1. Proper — Top number of fraction (numerator) is smaller than the bottom number of fraction (denominator)

EXAMPLE: $\frac{8}{9}$

INFORMATION SHEET

2. Improper — Top number of fraction (numerator) is larger than, or equal to, the bottom number of fraction (denominator)

   EXAMPLES: $\frac{8}{6}$ $\frac{7}{7}$

3. Mixed number — Contains a whole number and a fraction

   EXAMPLES: $9\frac{1}{2}$ $4\frac{2}{3}$ $1\frac{7}{8}$

B. Groups of fractions

1. Common — Two or more fractions that share the same denominator; sometimes called *like fractions*

   EXAMPLES: $\frac{3}{8}$ and $\frac{2}{8}$ $\frac{2}{5}$ and $\frac{3}{5}$

2. Uncommon — Two or more fractions that have different denominators; sometimes called *unlike fractions*

   EXAMPLES: $\frac{3}{8}$ and $\frac{2}{5}$ $\frac{1}{4}$ and $\frac{1}{5}$

X. Converting numbers and improper fractions (Assignment Sheet #12)

A. Convert mixed number to improper fraction

1. Multiply the denominator of the fraction by the whole number

2. Add the numerator of the fraction

   (NOTE: This number becomes the numerator.)

   EXAMPLES:

$$4\frac{3}{5} = \frac{(5 \times 4) + 3}{5}$$

$$= \frac{20 + 3}{5}$$

$$= \frac{23}{5}$$

$$7\frac{1}{2} = \frac{(2 \times 7) + 1}{2}$$

$$= \frac{14 + 1}{2}$$

$$= \frac{15}{2}$$

INFORMATION SHEET

B. Convert whole number to improper fraction

1. Choose a denominator

   (NOTE: Any number may be used.)

2. Multiply the whole number by the denominator and place the product over the denominator

   EXAMPLES: 8, expressed in fourths

$$8 = \frac{(8 \times 4)}{4}$$

$$= \frac{32}{4}$$

1, expressed in sixteenths

$$1 = \frac{(16 \times 1)}{16}$$

$$= \frac{16}{16}$$

C. Convert improper fraction to mixed number or whole number

1. Divide numerator by denominator and write quotient as whole number

2. If there is a remainder, form a fraction by placing the remainder over the original denominator

   EXAMPLES: $\frac{22}{5} = 22 \div 5$

$$= 4,\ R2$$

$$= 4\ \frac{2}{5}$$

$$\frac{7}{7} = 7 \div 7$$

$$= 1$$

INFORMATION SHEET

XI. Reducing fractions to lowest terms — Divide the numerator and denominator by the largest whole number other than 1 that will go into each of them evenly (Assignment Sheet #13)

EXAMPLES: $\frac{4}{6}$

(NOTE: $4/6$ is not reduced to lowest terms because both the numerator [4] and the denominator [6] can be divided by 2.)

$$\frac{4}{6} = \frac{(4 \div 2)}{(6 \div 2)}$$

$$= \frac{2}{3}$$

(NOTE: $2/3$ is reduced to lowest terms because the numerator [2] and the denominator [3] cannot be divided by the same number, other than 1.

$$\frac{12}{18}$$

(NOTE: $12/18$ can be reduced by dividing both the numerator and the denominator by 2, 3, or 6. To reduce to lowest terms, use the largest number, 6.)

$$\frac{12}{18} = \frac{(12 \div 6)}{(18 \div 6)}$$

$$= \frac{2}{3}$$

XII. Finding lowest common denominators (Assignment Sheet #14)

(NOTE: The lowest common denominator of two or more fractions is the lowest number that can be divided evenly by the denominators of each fraction.)

A. Determine a number which can be divided by each denominator evenly

(NOTE: This gives you a common denominator for the fractions. For small groups of fractions, two or three, the easiest way to determine this number is to multiply the denominators by each other. For example,

$\frac{3}{4}$ and $\frac{1}{8}$

$4 \times 8 = 32$.

32 is a common denominator for $3/4$ and $1/8$.)

INFORMATION SHEET

EXAMPLE: $\frac{3}{4}, \frac{1}{8}$, and $\frac{2}{3}$

24 is a common denominator

$24 \div 4 = 6$

$24 \div 8 = 3$

$24 \div 3 = 8$

B. Convert each fraction to one using the common denominator by multiplying both the numerator and the denominator by the number which changes the denominator to the common denominator

EXAMPLE: $\frac{3}{4}, \frac{1}{8}$, and $\frac{2}{3}$

$$\frac{3}{4} = \frac{(3 \times 6)}{(4 \times 6)}$$

$$= \frac{18}{24}$$

$$\frac{1}{8} = \frac{(1 \times 3)}{(8 \times 3)}$$

$$= \frac{3}{24}$$

$$\frac{2}{3} = \frac{(2 \times 8)}{(3 \times 8)}$$

$$= \frac{16}{24}$$

(NOTE: Multiplying both the numerator and the denominator by the same number does not change the value of the fraction. This operation is just the opposite of reducing a fraction to lowest terms. For example, $^{16}/_{24}$ is $^{2}/_{3}$ when reduced to lowest terms.)

INFORMATION SHEET

C. Reduce fractions to lowest terms that still have a common denominator

EXAMPLES: For $3/10$ and $1/3$, some common denominators are 30, 60, and 90. The lowest is 30, the lowest number that can be divided evenly by 10 and 3.

For $5/12$ and $3/8$ and $2/9$, some common denominators are 72, 144, and 216. The lowest common denominator is 72, the lowest number that can be divided evenly by 12, 8, and 9.

XIII. Adding fractions (Assignment Sheet #15)

A. Common fractions

1. Add the numerators

2. Place over common denominator

EXAMPLE:

$$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$$

3. Reduce to lowest terms, if required

B. Uncommon fractions

1. Change the fractions so that they have a common denominator

2. Add as common fractions

EXAMPLE:

$$\frac{1}{3} + \frac{2}{5} = \frac{(1 \times 5)}{(3 \times 5)} + \frac{(2 \times 3)}{(5 \times 3)}$$

$$= \frac{5}{15} + \frac{6}{15}$$

$$= \frac{11}{15}$$

3. Reduce to lowest terms, if required

C. Mixed numbers

1. Add whole numbers

2. Add fractions

INFORMATION SHEET

3. Total the two sets of numbers

EXAMPLES:

$$3\frac{3}{7} + 7\frac{2}{7} = (3 + 7) + \left(\frac{3}{7} + \frac{2}{7}\right)$$

$$= 10 + \frac{5}{7}$$

$$= 10\frac{5}{7}$$

$$4\frac{2}{3} + 1\frac{5}{6} = (4 + 1) + \left(\frac{2}{3} + \frac{5}{6}\right)$$

$$= (5) + \left(\frac{4}{6} + \frac{5}{6}\right)$$

$$= (5) + \frac{9}{6}$$

$$= (5) + 1\frac{3}{6}$$

$$= (5 + 1) + \frac{3}{6}$$

$$= (6) + \frac{1}{2}$$

$$= 6\frac{1}{2}$$

4. Reduce to lowest terms, if required

XIV. Subtracting fractions (Assignment Sheet #16)

A. Common fractions

1. Subtract the numerators
2. Place over denominator
3. Reduce to lowest terms, if required

EXAMPLE:

$$\frac{7}{10} - \frac{1}{10} = \frac{6}{10}$$

$$= \frac{3}{5}$$

INFORMATION SHEET

B. Uncommon fractions

1. Find common denominator
2. Subtract the numerators
3. Place numerators over common denominator
4. Reduce to lowest terms, if required

EXAMPLE: $\frac{2}{3} - \frac{1}{2} = \frac{4}{6} - \frac{3}{6}$

$= \frac{1}{6}$

C. Mixed numbers

1. Change mixed numbers to improper fractions
2. Change improper fractions to common fractions if necessary
3. Subtract the fractions
4. Convert to mixed number if possible
5. Reduce answer, if required

EXAMPLE: $5\frac{1}{3} - 3\frac{1}{2} = \frac{16}{3} - \frac{7}{2}$

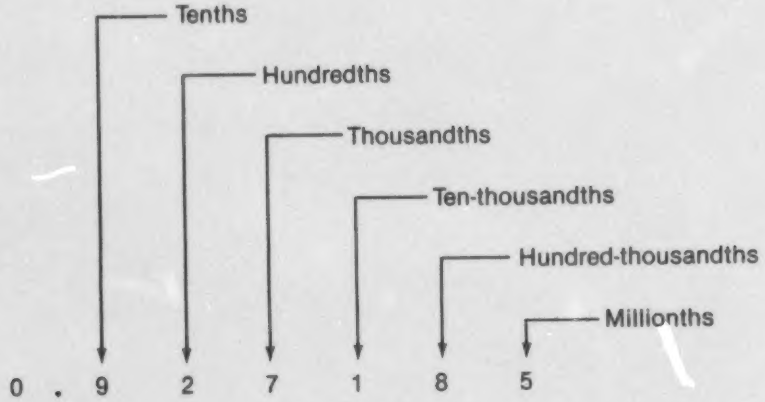
$= \frac{32}{6} - \frac{21}{6}$

$= \frac{11}{6}$

$= 1\frac{5}{6}$

INFORMATION SHEET

XV. Place value of decimals


Tenths
Hundredths
Thousandths
Ten-thousandths
Hundred-thousandths
Millionths
0 . 9 2 7 1 8 5

EXAMPLE: In the number above, the place values are

Tenths = $^{9}/_{10}$

Hundredths = $^{2}/_{100}$

Thousandths = $^{7}/_{1000}$

Ten-thousandths = $^{1}/_{10000}$

Hundred-thousandths = $^{8}/_{100000}$

Millionths = $^{5}/_{1000000}$

The number is read as nine hundred twenty-seven thousand, one hundred eighty-five millionths (0.927185)

XVI. Rounding off decimals

(NOTE: Often measurements, percentages, and other decimal values have more decimal places than you actually need. Rounding off decimals allows you to use approximate values which are more convenient to work with.)

A. Determine the number of decimal places needed for the required accuracy

B. Note the digit just to the right of the required decimal place

   1. If the digit is 0-4, drop all numbers to the right of the required decimal place

INFORMATION SHEET

2. If the digit is 5-9, add 1 to the number in the required decimal place and drop the numbers to the right

EXAMPLES:

a. Round off 6.81397 to hundredths

6.81397	The number to the right of the hundreths place is 0-4
6.81	Drop the numbers to the right of the hundredths place

b. Round off 6.81274 to thousandths

6.81274	The number to the right of the thousandths place is 5-9
6.813	Add 1 to the thousandths place and drop the numbers to the right

XVII. Adding decimals (Assignment Sheet #18)

A. Write the given numbers in a column with the decimal points directly under each other

(NOTE: Whole numbers, such as 7 or 75 or 753, have *understood* decimal points, such as 7.00 or 75.00 or 753.00.)

B. Add each column of numbers the same as for regular whole numbers

C. Locate the decimal point in the answer by placing it directly under the decimal points above

EXAMPLE: 0.857 + 2.1 + 370.057 + 753 = 1126.014

$$\begin{array}{r} 0.857 \\ 2.1 \\ 370.057 \\ +\ 753. \\ \hline 1126.014 \end{array} \quad \text{OR} \quad \begin{array}{r} 0.857 \\ 2.100 \\ 370.057 \\ +\ 753.000 \\ \hline 1126.014 \end{array}$$

(NOTE: Zeros may be added so that each number has the same number of decimal places.)

INFORMATION SHEET

XVIII. Subtracting decimals (Assignment Sheet #19)

A. Solving problems

1. Write the given numbers so that the decimal points are under each other
2. Subtract each column of numbers the same as for regular whole numbers
3. Locate the decimal point in the answer (difference) by placing it under the above decimal points

EXAMPLE:

$$\begin{array}{r} 8.120 \\ -\ 1.397 \\ \hline 6.723 \end{array}$$

B. Checking problems

1. Add the answer (difference) and the number just above it
2. Notice that the sum must be the same as the top number in the problem for the answer to be correct

EXAMPLE:

$$\begin{array}{r} 8.120 \\ -\ 1.397 \\ \hline 6.723 \end{array} \qquad \text{Check} \quad \begin{array}{r} 1.397 \\ +\ 6.723 \\ \hline 8.120 \end{array}$$

(NOTE: If problem contains a whole number, you may add as many zeros to the right of the decimal point as you need.)

XIX. Multiplying decimals (Assignment Sheet #20)

A. Multiply the same as whole numbers

(NOTE: In setting up multiplication problems, you do not need to place the decimal points in columns.)

B. Total the number of decimal places to the right of the decimal points in the factors being multiplied

INFORMATION SHEET

C. Locate the decimal point by starting at the extreme right digit in the answer and counting off as many places to the left as the total found in step B indicates

EXAMPLES: Multiply 27.125 by 7.75

27.125 — 3 places
× 7.75 — 2 places
135625
189875
+ 189875
210.21875 — 5 places

Multiply 2.5 by .25

2.5 — 1 places
× .25 — 2 places
125
+ 50
.625 — 3 places

(NOTE: You may round off the answer if the decimal is carried out to more places than you need.)

XX. Dividing a decimal

A. Dividing a decimal by a decimal (Assignment Sheet #21)

1. Count the number of digits to the right of the decimal point in the divisor

2. Place a caret (∧) at the end of the number, making divisor a whole number

3. Count as many digits to the right of the decimal point in the dividend as you counted in the divisor

4. Place a caret after the last digit you count

   (NOTE: You may need to place some zeros in the dividend to the right of the last digit.)

5. Place the decimal point in the quotient directly above the caret in the dividend

INFORMATION SHEET

6. Divide as with whole numbers

   (NOTE: You may round off the answer if the answer is carried out to more places than you need.)

7. Check by multiplying the quotient and the divisor

EXAMPLES:

$$\begin{array}{r} 0.5 \\ 0.5_{\wedge}\overline{)0.2_{\wedge}5} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.5 \\ \times\ 0.5 \\ \hline 0.25 \end{array}$$

$$\begin{array}{r} 5. \\ 0.05_{\wedge}\overline{)0.25_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.05 \\ \times\ 05 \\ \hline 0.25 \end{array}$$

$$0.005\overline{)0.25} \quad \text{becomes} \quad \begin{array}{r} 50. \\ 0.005_{\wedge}\overline{)0.250_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 0.005 \\ \times\ 50 \\ \hline 0.250 \end{array}$$

B. Dividing a whole number by a decimal (Assignment Sheet #21)

1. Place a decimal point in the dividend at the right side of the number

2. Count the number of digits to the right of the decimal point in the divisor

3. Place a caret (∧) at the end of the number

4. Write as many zeros after the decimal point in the dividend as you counted places in the divisor

5. Place a caret after the last zero

6. Divide as with whole numbers

   (NOTE: Zeros may need to be added to the dividend beyond the caret if the division does not come out even.)

7. Place a decimal point in the quotient directly above the caret in the dividend

8. Check by multiplying the divisor and quotient

EXAMPLE:

$$0.03\overline{)\ 9} \quad \text{becomes} \quad \begin{array}{r} 300. \\ 0.03_{\wedge}\overline{)9.00_{\wedge}} \end{array} \qquad \text{Check} \quad \begin{array}{r} 300 \\ \times\ 0.03 \\ \hline 9.00 \end{array}$$

INFORMATION SHEET

XXI. Converting decimals to fractions (Assignment Sheet #22)

A. Determine the number of places to the right of the decimal point

B. Write a 1 followed by the same number of zeros as there are numbers to the right of the decimal point; make this number the denominator

C. Write the decimal figure to the right of the decimal point as the numerator

D. Reduce if required

E. Write the decimal figure to the left of the decimal as the whole number of a mixed number if required

EXAMPLES:

$$.75 = \frac{75}{100} = \frac{3}{4}$$

$$62.003 = 62\frac{3}{1000}$$

XXII. Converting fractions to decimals (Transparency #2; Assignment Sheet #22)

A. Fractions with ten or a power of ten as a denominator

(NOTE: A power of ten is a number which consists of 1 followed by any number of zeros, such as 10; 100; 1000; 1,000,000; etc.)

1. Write a decimal point
2. Allow as many places to the right of the decimal point as there are zeros in the denominator
3. Write the numerator so that the last digit in the numerator is in the last decimal place to the right of the decimal point
4. Place a zero in any remaining decimal places between the decimal point and the numerator number

EXAMPLES: $\frac{1}{10} = 0.1$ $\frac{3}{100} = 0.03$ $\frac{79}{100} = 0.79$

INFORMATION SHEET

B. For fractions with denominators other than power of 10

1. Divide the numerator by the denominator
2. Round off as required

   (NOTE: Some fractions will never divide evenly and must be rounded off.)

EXAMPLES: $\frac{1}{2} = 1 \div 2$

$= .5$

$$\begin{array}{r} .5 \\ 2\overline{)1.0} \\ \underline{1\,0} \end{array}$$

$\frac{2}{3} = 2 \div 3$

$= .67$

$$\begin{array}{r} .66 \\ 3\overline{)2.00} \\ \underline{18} \\ 20 \\ \underline{18} \\ 2 \end{array}$$

(NOTE: Notice that no matter how many places you carry the division out the quotient will produce an endless series of 6's. Round off the number at the required decimal place.)

C. Mixed numbers

(NOTE: Convert improper fractions to mixed numbers.)

1. Convert the fraction as required
2. Place the whole number to the left of the decimal point

EXAMPLES: $6\frac{7}{10} = 6 + 0.7$

$= 6.7$

$4\frac{3}{8} = 4 + (3 \div 8)$

$= 4 + (.375)$

$= 4.375$

INFORMATION SHEET

XXIII. Converting decimals and fractions to percentages (Assignment Sheet #23)

(NOTE: *Percent* means that a number is expressed as a decimal part of 100.)

A. Decimals as percentages

1. Move the decimal point two places to the right
2. Place the percent symbol (%) after the number

EXAMPLE: .375 = 37.5%

B. Fractions as percentages

1. Convert the fraction to a decimal
2. Express the decimal as a percentage

EXAMPLE: $\frac{7}{8}$ as a percentage

$$\frac{7}{8} = 7 \div 8$$

$$= .875$$

$$= 87.5\%$$

XXIV. Converting percentages to decimals and fractions (Assignment Sheet #24)

A. Percentages as decimals

1. Drop the percent symbol
2. Move the decimal point two places to the left

EXAMPLES: 78.7% = .787

186% = 1.86

INFORMATION SHEET

B. Percentages as fractions

1. Write the percentage as a decimal

2. Convert the decimal to a fraction

EXAMPLES: $24.6\% = .246$

$$= \frac{246}{1000}$$

$$= \frac{123}{500}$$

$119\% = 1.19$

$$= 1\frac{19}{100}$$

XXV. Solving percentage problems (Assignment Sheets #25 and #26)

(NOTE: Percentage problems may involve solving for any of three different numbers. You may solve for the percent of a total amount, as in "16 is what percent of 80?" or you may have to figure the total amount if you know the percentage, as in "16 is 20% of what number?". The total amount is called the "whole." Or you may calculate the "part." The part is the number which is a given percent of the whole, as in "what number is 20% of 80?")

A. Write the unknown as "X"

(NOTE: The unknown may be the percent, the part, or the whole.)

B. Write any percentage as a fraction with a denominator of 100

(NOTE: If you are solving for an unknown percent, place X over 100.)

EXAMPLE: 16 is what percent of 80? $\frac{X}{100}$

C. Write the part and the whole as a fraction with the part over the whole

EXAMPLE: $\frac{16}{80}$

D. Write the two fractions with an equal sign between them

EXAMPLE: $\frac{X}{100} = \frac{16}{80}$

INFORMATION SHEET

E. Multiply each side of the equation to produce identical denominators

1. Multiply the left side numerator and denominator each by the right side denominator

   (NOTE: Multiplying the numerator and denominator of a fraction by the same number does not change the value of the fraction. This is like the procedure for converting fractions to fractions with common denominators.)

   EXAMPLE: $\frac{80 \times X}{80 \times 100}$

2. Multiply the right side numerator and denominator each by the left side denominator

   EXAMPLE: $\frac{16 \times 100}{80 \times 100}$

3. Write the two fractions with the common denominator

   EXAMPLE: $\frac{80X}{8000} = \frac{1600}{8000}$

F. Eliminate the denominators

(NOTE: Mathematically, this is done by multiplying each side by the denominator. For example,

$$8000 \times \frac{80X}{8000} = \frac{1600}{8000} \times 8000.$$

If you multiply each side of an equation by the same number they are still equal. This number cancels out the denominator because this is like multiplying the numerator by the same number it is being divided by in the fraction. For example,

$$\frac{8000 \times 80X}{8000}$$

is the same as

$$(8000 \times 80X) \div 8000.$$

By knowing this principle you may simply eliminate the common denominator.)

EXAMPLE: $80X = 1600$

INFORMATION SHEET

G. Solve for X by dividing each side of the equation by the multiplier of X

EXAMPLE: $80X \div 80 = 1600 \div 80$

$$X = 20\%$$

16 is 20% of 80.

(NOTE: Study the examples below of solving for the part and the whole when the percentage is known.)

EXAMPLES:

1. 5% of 97.3 is what number?

   Write the percentage as a fraction over 100 and the part over the whole

   $$\frac{5}{100} = \frac{X}{97.3}$$

   Convert the fractions to common denominators

   $$\frac{97.3 \times 5}{97.3 \times 100} = \frac{X \times 100}{97.3 \times 100}$$

   $$\frac{486.5}{9730} = \frac{100X}{9730}$$

   Eliminate the denominators

   $486.5 = 100X$

   Solve for X

   $4.865 \div 100 = X$

   $4.865 = X$

   5% of 97.3 is 4.865

INFORMATION SHEET

2. 26 is 40% of what number?

Write the percentage as a fraction over 100 and the part over the whole

$$\frac{40}{100} = \frac{26}{X}$$

Convert the fractions to common denominators

$$\frac{X \times 40}{X \times 100} = \frac{26 \times 100}{X \times 100}$$

$$\frac{40X}{100X} = \frac{2600}{100X}$$

Eliminate the denominators

$40X = 2600$

Solve for X

$X = 2600 \div 40$

$X = 65$

26 is 40% of 65

BASIC MATH
UNIT II

ASSIGNMENT SHEET #1 — SOLVE ONE-DIGIT ADDITION PROBLEMS

NAME ______________________________ SCORE ______________

Like most people, you probably use addition every day. Today, for example you may have added coins together to pay for a cup of coffee or a snack. Every time you add, you use some basic addition facts. The numbers that are added together are called *addends.* The answer obtained in the addition problem is called the *sum* or *total.*

Although this exercise is a very simple one, it will form part of your math background and serve as the basis for completing further exercises or problems.

EXAMPLE:

$$\begin{array}{r} 4 \\ \underline{+\,8} \\ 12 \end{array}$$

Solve each of the following addition problems.

1. a. 7 +1	b. 2 +9	c. 2 +5	d. 2 +8	e. 4 +4	f. 4 +1	g. 3 +1
h. 3 +3	i. 1 +1	j. 9 +2	k. 8 +8	l. 8 +3	m. 1 +6	n. 9 +8
2. a. 1 +9	b. 0 +5	c. 8 +1	d. 6 +6	e. 0 +4	f. 3 +6	g. 0 +2
h. 3 +8	i. 3 +4	j. 3 +9	k. 2 +3	l. 3 +5	m. 8 +3	n. 5 +8

ASSIGNMENT SHEET #1

3. Find total height of a building if the first floor is 9 ft, the second floor 8 ft, and the third floor 8 ft.

   Total height = ______________________________ feet

4. If one side of a pool is 6 ft, another side is 4 ft, and the two ends are 3 ft each, what is the perimeter?

   Perimeter = ______________________________ feet

5. If you use 4 cartons of yellow glazed wall tile, 8 cartons of off-white glazed wall tile, and 3 cartons of sea green glazed wall tile, what are the total cartons used?

   Total cartons used = ______________________________ cartons

BASIC MATH
UNIT II

ASSIGNMENT SHEET #2 — SOLVE TWO-DIGIT ADDITION PROBLEMS

NAME ______________________________ SCORE ______________

In adding numbers with more than one digit, note that the digits on the left of the ones (units) column in no way affect the sum of the digits in the ones column. Also, each of the problems below will require *carrying*.

EXAMPLE:	1	Carried number	7 + 5 = 12
	67		Record the 2 and carry the 1
	+ 25		The carried 1 + 6 + 2 = 9
	92		Record the 9

Solve each of the following addition problems.

1.	a. 49 81 + 27	b. 37 74 + 66	c. 92 38 + 77	d. 87 26 + 44	e. 44 57 + 63
2.	a. 28 41 + 82	b. 36 81 + 74	c. 67 38 + 43	d. 64 78 + 32	e. 72 38 + 25
3.	a. 72 38 + 25	b. 87 29 + 41	c. 26 17 + 84	d. 38 29 + 72	e. 41 59 + 67
4.	a. 82 78 32 18 96 + 54	b. 47 63 82 28 99 + 51	c. 74 36 45 87 23 + 45	d. 18 92 47 63 93 + 27	e. 75 48 35 62 51 + 48
5.	a. 17 23 36 45 82 90 + 41	b. 57 63 92 83 45 67 + 32	c. 13 93 62 56 98 87 + 60	d. 39 46 72 53 40 79 + 81	e. 32 87 40 79 53 62 + 81

ASSIGNMENT SHEET #2

6. How much setting material would it take for a job in which the floor needs 42 sq ft, one wall needs 76 sq ft, and another wall needs 34 sq ft?

Total = ________________ square feet

7. How many square feet of tile are required to do a job in which one bedroom is 64 sq ft, the master bedroom is 97 sq ft, and the entry is 32 sq ft?

Total = ________________ square feet

8. How much fuel was used in one day for all the company vans when #1 van used 20 gals, #2 van used 22 gals, #3 van used 25 gals, #4 van used 32 gals, and #5 van used 16 gals?

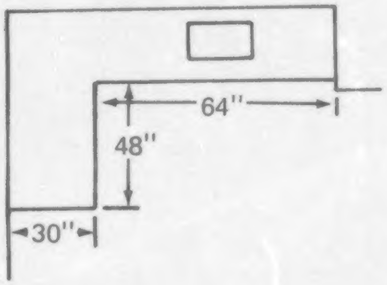
Total = ________________ gallons

9. What is the total number of cartons contained in a tile shipment with 19 cartons for one bedroom, 16 cartons for another bedroom, 21 cartons for the kitchen, 11 cartons for the dining room, and 13 cartons for the entry?

Total = ________________ cartons

10. How many lineal inches of trim are needed for an L-shaped counter top with the dimensions shown in the figure below?

Total = ________________ lineal inches



BASIC MATH
UNIT II

ASSIGNMENT SHEET #3 — SOLVE THREE-DIGIT ADDITION PROBLEMS

NAME ________________________ SCORE ____________

The more digits that you are adding, the more important it becomes to make small, legible figures and keep digits in straight columns. It may help to keep your pencil sharp and to have an extra pencil.

EXAMPLE:

$$\begin{array}{r} 539 \\ 333 \\ +\ 432 \\ \hline 1304 \end{array}$$

2 + 3 + 9 = 14
Record the 4 and carry the 1
The carried 1 + 3 + 3 + 3= 10
Record the 0 and carry the 1
The carried 1 + 5 + 3 + 4 = 13
Record the 13

Solve each of the following addition problems.

(NOTE: Do not forget the numerals that must be carried.)

1.

a.	b.	c.	d.
576	333	747	909
953	478	324	636
462	962	600	877
+ 615	+ 510	+ 598	+ 965

e.	f.	g.	h.
396	923	327	270
728	934	240	368
220	966	136	609
+ 494	+ 123	+ 238	+ 224

2. In a certain house, the tile setter applied 528 sq ft of ceramic tile in the kitchen, 640 sq ft in the living room and entry way, and 580 sq ft in the dining room. How many square feet did the tile setter apply?

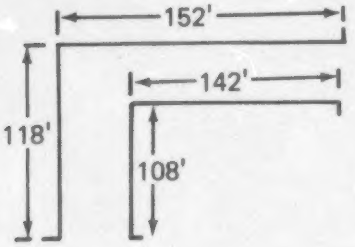
   Total = ________________ square feet

ASSIGNMENT SHEET #3

3. If a tile setter works 164 hours in January, 158 hours in February, 206 hours in March, 187 hours in April, 218 hours in May, and 210 hours in June, how many hours has the tile setter worked during the first half of the year?

Total = ________________ hours

4. How many feet of base trim are required for an L-shaped hallway with the dimensions shown? There are no doors in the side walls and base trim is not required for the end walls.



Total = ________________ lineal feet

5. If one crew installs 175 sq ft of tile; another 125 sq ft of tile; another, 219 sq ft; another, 423 sq ft; and another, 789 sq ft, how many total square feet were installed?

Total = ________________ square feet

BASIC MATH
UNIT II

ASSIGNMENT SHEET #4 — SOLVE ONE-DIGIT SUBTRACTION PROBLEMS

NAME ______________________________ SCORE ______________

Addition is the first fundamental operation in mathematics. Subtraction, the process of finding the difference between two numbers, is the second fundamental operation.

EXAMPLE:
$$\begin{array}{r}7\\-\ 5\\\hline 2\end{array}$$

Solve each of the following subtraction problems to find the difference or remainder.

1.	a. $\begin{array}{r}6\\-\ 1\\\hline\end{array}$	b. $\begin{array}{r}2\\-\ 1\\\hline\end{array}$	c. $\begin{array}{r}5\\-\ 2\\\hline\end{array}$	d. $\begin{array}{r}6\\-\ 3\\\hline\end{array}$	e. $\begin{array}{r}3\\-\ 1\\\hline\end{array}$	f. $\begin{array}{r}7\\-\ 1\\\hline\end{array}$	g. $\begin{array}{r}4\\-\ 3\\\hline\end{array}$
	h. $\begin{array}{r}5\\-\ 3\\\hline\end{array}$	i. $\begin{array}{r}5\\-\ 4\\\hline\end{array}$	j. $\begin{array}{r}1\\-\ 1\\\hline\end{array}$	k. $\begin{array}{r}8\\-\ 1\\\hline\end{array}$	l. $\begin{array}{r}4\\-\ 2\\\hline\end{array}$	m. $\begin{array}{r}6\\-\ 6\\\hline\end{array}$	n. $\begin{array}{r}4\\-\ 1\\\hline\end{array}$
2.	a. $\begin{array}{r}9\\-\ 6\\\hline\end{array}$	b. $\begin{array}{r}8\\-\ 2\\\hline\end{array}$	c. $\begin{array}{r}10\\-\ 4\\\hline\end{array}$	d. $\begin{array}{r}8\\-\ 8\\\hline\end{array}$	e. $\begin{array}{r}9\\-\ 3\\\hline\end{array}$	f. $\begin{array}{r}7\\-\ 3\\\hline\end{array}$	g. $\begin{array}{r}6\\-\ 0\\\hline\end{array}$
	h. $\begin{array}{r}6\\-\ 2\\\hline\end{array}$	i. $\begin{array}{r}10\\-\ 9\\\hline\end{array}$	j. $\begin{array}{r}10\\-\ 1\\\hline\end{array}$	k. $\begin{array}{r}10\\-\ 2\\\hline\end{array}$	l. $\begin{array}{r}7\\-\ 6\\\hline\end{array}$	m. $\begin{array}{r}9\\-\ 5\\\hline\end{array}$	n. $\begin{array}{r}8\\-\ 7\\\hline\end{array}$
3.	a. $\begin{array}{r}4\\-\ 1\\\hline\end{array}$	b. $\begin{array}{r}2\\-\ 2\\\hline\end{array}$	c. $\begin{array}{r}7\\-\ 5\\\hline\end{array}$	d. $\begin{array}{r}6\\-\ 4\\\hline\end{array}$	e. $\begin{array}{r}8\\-\ 5\\\hline\end{array}$	f. $\begin{array}{r}13\\-\ 6\\\hline\end{array}$	g. $\begin{array}{r}15\\-\ 8\\\hline\end{array}$
	h. $\begin{array}{r}11\\-\ 7\\\hline\end{array}$	i. $\begin{array}{r}11\\-\ 5\\\hline\end{array}$	j. $\begin{array}{r}11\\-\ 8\\\hline\end{array}$	k. $\begin{array}{r}9\\-\ 2\\\hline\end{array}$	l. $\begin{array}{r}10\\-\ 3\\\hline\end{array}$	m. $\begin{array}{r}14\\-\ 7\\\hline\end{array}$	n. $\begin{array}{r}16\\-\ 9\\\hline\end{array}$

ASSIGNMENT SHEET #4

4. If a wall is 9 ft long and has a 2-foot door opening, how many feet of base trim are needed?

   Difference = ________________ lineal feet

5. A carton of 25 tiles arrived in a job shipment. How many tiles are usable if 4 of the tiles were broken in shipping?

   Difference = ________________ tiles

6. A tile setter uses 3 pounds of grout mix from a 10-pound bag. How many pounds are left?

   Difference = ________________ pounds

7. If 9 rooms in a house must be tiled and a tile setter has completed 6 rooms, how many rooms are left to be done?

   Difference = ________________ rooms

ASSIGNMENT SHEET #4

8. A tile setter estimated that tiling a counter would require 11 hours to complete. How many hours are left in the estimated time after the tile setter has spent 7 hours on the job?

   Difference = ________________ hours

9. A supplier offered ceramic tiles in 13 colors. How many colors are still available if the supplier discontinues 4 colors?

   Difference = ________________ colors

10. A tile setter needs to determine the number of hours spent on a job in order to figure the labor charge. If the tile setter was at the job site for 9 hours and took 1 hour for lunch, how many hours were spent working on the job?

    Difference = ________________ hours

BASIC MATH
UNIT II

ASSIGNMENT SHEET #5 — SOLVE TWO-, THREE-, AND FOUR-DIGIT SUBTRACTION PROBLEMS

NAME ______________________________ SCORE ______________

Subtraction is the opposite of addition. You can check the accuracy of the answer obtained in a subtraction problem by simply adding the difference to the subtrahend. The sum of these two numbers must equal the minuend if the answer is correct.

EXAMPLE:	57	Subtract 5 from 7 and record the 2
	−35	Subtract 3 from 5 and record the 2
	22	Answer or difference is 22
		Check by adding difference to subtrahend
		22 + 35 = 57

Solve each of the following subtraction problems to find the difference or remainder; check your answers by adding the difference to the subtrahend.

1.	a. 75 −56	b. 84 −57	c. 4635 −3187	d. 4178 −1539
2.	a. 218 −119	b. 983 −656	c. 771 −289	d. 53 −39
3.	a. 74 −26	b. 62 −29	c. 77 −39	d. 123 − 67
4.	a. 111 − 79	b. 204 − 78	c. 356 −178	d. 378 −179
5.	a. 4890 − 362	b. 365 −209	c. 6720 −4890	d. 7650 −2312

6. A house requires 643 sq ft of tile. How much is left to be done after 426 sq ft have been installed?

   Difference = ______________ square feet

ASSIGNMENT SHEET #5

7. The perimeter of a room is 56 ft. How many lineal feet of base trim is required if the total width of all doorways is 13 ft?

Difference = ________________ lineal feet

8. When a tile setter left the office this morning, the mileage on the van was 7937 miles. How many miles were driven if the mileage at the end of the day is 8023?

Difference = ________________ miles

9. A pallet of mortar mix holds 1300 pounds of mortar. If 390 pounds are delivered to a job, how much is left on the pallet?

Difference = ________________ pounds

10. A tile setter ordered 350 tiles for a job. During shipping, 17 tiles were broken. How many tiles did the job require if the tilesetter has 19 tiles left after completing the job?

Difference = ________________ tiles

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BASIC MATH
UNIT II

ASSIGNMENT SHEET #6 — SOLVE ONE-DIGIT MULTIPLICATION PROBLEMS

NAME ______________________________ SCORE ______________

Multiplication is the third basic operation in mathematics. It is a shortcut method of adding. For example, if you correctly add twelve 12's, the result will be 144, the same as 12 multiplied by 12.

EXAMPLE: 7 × 8 = 56

$$\begin{array}{r} 8 \\ \times\ 7 \\ \hline 56 \end{array}$$

Solve each of the following multiplication problems to find the products.

1. a. 6 ×2	b. 0 ×4	c. 3 ×6	d. 0 ×2	e. 2 ×4	f. 3 ×0	g. 4 ×5
h. 9 ×8	i. 6 ×7	j. 8 ×3	k. 8 ×2	l. 6 ×4	m. 1 ×4	n. 9 ×1
2. a. 5 ×6	b. 6 ×6	c. 3 ×2	d. 4 ×3	e. 1 ×5	f. 9 ×9	g. 5 ×5
h. 2 ×6	i. 9 ×3	j. 8 ×6	k. 6 ×5	l. 3 ×8	m. 3 ×4	n. 3 ×9
3. a. 9 ×3	b. 3 ×5	c. 6 ×3	d. 7 ×3	e. 7 ×7	f. 8 ×7	g. 4 ×8
h. 8 ×5	i. 9 ×6	j. 5 ×2	k. 4 ×9	l. 1 ×2	m. 5 ×3	n. 8 ×8

ASSIGNMENT SHEET #6

4.	a. 8 ×3	b. 5 ×9	c. 5 ×5	d. 7 ×7	e. 8 ×5	f. 7 ×9	g. 5 ×8
	h. 9 ×7	i. 6 ×8	j. 6 ×9	k. 7 ×6	l. 2 ×9	m. 2 ×5	n. 6 ×8
5.	a. 4 ×4	b. 4 ×8	c. 8 ×8	d. 6 ×6	e. 7 ×8	f. 9 ×9	g. 8 ×9
	h. 8 ×5	i. 7 ×7	j. 3 ×3	k. 6 ×7	l. 9 ×4	m. 8 ×5	n. 7 ×5

6. If a sheet of mosaic tiles covers 2 sq ft, how many sq ft will 9 sheets cover?

Product = ________________ square feet

7. What is total area of a tile face that is 2" × 2"?

Product = ________________ square inches

8. What is total number of cartons needed of you are going to use 9 cartons per job on 7 jobs?

Product = ________________ cartons

ASSIGNMENT SHEET #6

9. How many square feet of tile are required to cover the ceiling over a bathtub if the ceiling is 3 ft by 5 ft?

   Product = ________________ square feet

10. If each bag of grout mix weighs 5 pounds, how much do 8 bags weigh?

    Product = ________________ pounds

BASIC MATH
UNIT II

ASSIGNMENT SHEET #7 — SOLVE MULTIPLICATION PROBLEMS WITH ONE-DIGIT MULTIPLIERS

NAME ______________________________ SCORE ______________

Some multiplication problems involve *carrying*. You may write down the carried numerals, or simply remember them. Use the method that works better for you.

EXAMPLE:

EXAMPLE:	1 53 × 4 2	Carried number 4 × 3 = 12 Record the 2 and carry the 1
	1 53 × 4 212	Carried number 4 × 5 = 20 20 + the carried 1 = 21 Record the 21 Answer 212

Solve each of the following multiplication problems to find the products.

1.	a. 53 × 4	b. 32 × 3	c. 26 × 4	d. 41 × 8	e. 57 × 4
2.	a. 342 × 2	b. 453 × 5	c. 156 × 4	d. 703 × 5	e. 659 × 3
3.	a. 3245 × 6	b. 1203 × 3	c. 2421 × 4	d. 5103 × 5	e. 4356 × 7
4.	a. 481 × 7	b. 3758 × 6	c. 4256 × 4	d. 908 × 6	e. 3497 × 9

5. If I install 225 sq ft of tile per day, how many square feet do I install in 7 days?

Product = ______________ square feet

ASSIGNMENT SHEET #7

6. If there are 125 trim tiles in a carton, how many trim tiles are there in 6 cartons?

   Product = ________________ trim tiles

7. A tile setter is tiling the bathrooms in a new motel. If each bath requires 137 sq ft of tile and there are 9 bathrooms in the motel, what is the total amount of tile required for the job?

   Product = ________________ square feet

8. A pallet of tile weighs 315 pounds. What is the total weight of 2 pallets?

   Product = ________________ pounds

9. A company wants to buy 7 vans. How much will it cost if each van is priced at $8,367?

   Product = ________________ dollars

10. A company has 8 crews which each average installing 561 sq ft of tile per day. On the average, how many total square feet of tile could all of the crews set in a 5-day work week?

    Product = ________________ square feet

BASIC MATH
UNIT II

ASSIGNMENT SHEET #8 — SOLVE MULTIPLICATION PROBLEMS WITH TWO- AND THREE-DIGIT MULTIPLIERS

NAME ______________________________ SCORE ______________

When multiplying by numbers which contain two or more digits, you must be careful to align the partial products properly. The right-hand digit of each partial product is written directly below the multiplying digit. This causes the partial products to be properly aligned so that the tens will be added to tens, hundreds to hundreds, etc.

EXAMPLE:		
	11	Carried numbers
	756	
	× 312	
	1512	First partial product
	756	Second partial product
	2268	Third partial product
	235872	Product

Solve each of the multiplication problems below to find the products:

	a.	b.	c.	d.	e.	f.
1.	63 ×38	85 ×76	32 ×59	42 ×96	73 ×64	54 ×83
2.	95 ×74	95 ×54	67 ×43	64 ×77	82 ×77	99 ×67
3.	556 ×554	949 ×979	262 ×192	567 ×485	879 ×729	889 ×445

4. If a load of tile weighs 18,796 lbs, how much would 78 loads weigh?

   Product = ________________ pounds

ASSIGNMENT SHEET #8

5. If a tile store could stockpile 676 cartons of tile in one day, how much could be stockpiled in 14 days?

Product = ________________ cartons

6. How many tiles are there in 63 cartons of tile if there are 25 tiles per carton?

Product = ________________ tiles

7. A restaurant dining room measures 87 ft by 131 ft. What is the area of the room?

Product = ________________ sq ft

8. When the tile was installed in the restaurant, there were 164 tiles along the short side and 262 tiles along the long side. How many tiles were used on the floor?

Product = ________________ tiles

9. A tile setter averages 209 hours of work per month. How many hours would the tilesetter work in 11 months?

Product = ________________ hours

ASSIGNMENT SHEET #8

10. Each room of a new hotel requires 343 sq ft of tile. There are 27 rooms per floor. How many square feet of tile are required for the hotel if there are rooms on 36 floors?

Product = ________________ square feet

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BASIC MATH
UNIT II

ASSIGNMENT SHEET #9 — SOLVE DIVISION PROBLEMS WITH ONE-DIGIT DIVISORS

NAME ______________________________ SCORE ______________

Division is the fourth and last basic operation in mathematics. Multiplication puts together — division takes apart. Division is really the reverse of multiplication.

EXAMPLE: $972 \div 3 = 324$

$$\begin{array}{r} 324 \\ 3\overline{)972} \\ \underline{9} \\ 7 \\ \underline{6} \\ 12 \\ \underline{12} \end{array}$$

Solve each of the following division problems to find the quotient.

(NOTE: You can check your own answers to division problems by multiplying.)

1. a. $3\overline{)6}$ b. $7\overline{)21}$ c. $5\overline{)225}$ d. $6\overline{)3600}$

2. a. $5\overline{)5}$ b. $4\overline{)16}$ c. $8\overline{)96}$ d. $9\overline{)81}$

ASSIGNMENT SHEET #9

3. a. $6\overline{)728}$ b. $8\overline{)4080}$ c. $9\overline{)108}$ d. $8\overline{)136}$

4. a. $7\overline{)49}$ b. $7\overline{)749}$ c. $4\overline{)48}$ d. $9\overline{)819}$

5. a. $5\overline{)830}$ b. $6\overline{)6702}$ c. $7\overline{)2884}$ d. $9\overline{)279}$

6. If a container of setting material covers 75 sq ft and there are 3 gallons of setting material in a container, how much does each gallon cover?

Quotient = ________________ square feet

ASSIGNMENT SHEET #9

7. How many 8-inch paver tiles are required to cover a length of 816"?

Quotient = ________________ tiles

8. If a sheet of back-mounted mosaic covers 2 sq ft, how many sheets are required to cover an area of 18 sq ft?

Quotient = ________________ sheets

9. How many square feet of tile were installed on the average each day if a tile setter installed 1155 sq ft of tile in a 5-day period?

Quotient = ________________ square feet

10. How many pieces of 6" cap are required to trim a tiled section 126" in length?

Quotient = ________________ pieces

BASIC MATH
UNIT II

ASSIGNMENT SHEET #10 — SOLVE LONG-DIVISION PROBLEMS

NAME ______________________________ SCORE ______________

Long division is the name used for division by numbers that cannot readily be used as simple divisors. The individual products and remainders, because of their length, are written.

EXAMPLE: $5678 \div 51 = 111$, R (remainder) 17

$$\begin{array}{rl}
111 & \text{quotient} \\
51\overline{)5678} & \\
\underline{51} & \\
57 & \\
\underline{51} & \\
68 & \\
\underline{51} & \\
17 & \text{remainder}
\end{array}$$

Solve each of the following division problems.

1. a. $12\overline{)24}$ b. $30\overline{)90}$ c. $66\overline{)198}$

2. a. $15\overline{)60}$ b. $23\overline{)276}$ c. $19\overline{)152}$

ASSIGNMENT SHEET #10

3. a. $86\overline{)1032}$ b. $11\overline{)121}$ c. $66\overline{)198}$

4. a. $52\overline{)468}$ b. $73\overline{)1095}$ c. $20\overline{)400}$

5. a. $47\overline{)1175}$ b. $79\overline{)632}$ c. $99\overline{)396}$

6. a. $26\overline{)8507}$ b. $62\overline{)7739}$ c. $28\overline{)5212}$

ASSIGNMENT SHEET #10

7. a. 34)5950 b. 17)8364 c. 71)18318

8. a. 43)10965 b. 56)7616 c. 92)30084

9. a. 37)26679 b. 7)4228 c. 15)24[illegible]0

10. a. 15)4530 b. 26)52260 c. 13)91169

ASSIGNMENT SHEET #10

11. a. $34\overline{)17238}$ b. $36\overline{)10080}$ c. $17\overline{)53040}$

12. If a company van travels 4,572 miles a year, how far would it travel in one month?

Quotient = ________________ miles

13. If a tilesetting crew of 9 installed tile on a 12,933 sq ft surface in five days, what was the expected square footage installed by each of the workers?

Quotient = ________________ square feet

14. If the tile work in an office complex with 33 offices (each the same size) required a total of 4983 sq ft of tile, how large an area was tiled in each office?

Quotient = ________________ square feet

ASSIGNMENT SHEET #10

15. A job requires 6750 tiles. If there are 125 tiles per carton, how many cartons are required?

Quotient = ________________ cartons

16. If a pallet of tiles weighs 1700 pounds and there are 50 cartons on the pallet, how much does each carton weigh?

Quotient = ________________ pounds

17. How many days will be required to do a job if a tile setter averages 220 sq ft per day and the total surface area to be tiled is 2090 sq ft?

Quotient = ________________ days

18. If a gallon of setting material will cover 75 sq ft of surface area, how many gallons will be required to do a job with 13,684 sq ft?

Quotient = ________________ gallons

ASSIGNMENT SHEET #10

19. How many cartons of tile are required for a 9036 sq ft job if each carton will cover 12 sq ft?

    Quotient = ________________ cartons

20. How many workers are required to install a job in 14 days if each worker averages 212 sq ft of tile per day and the total area to be covered is 32,648 sq ft?

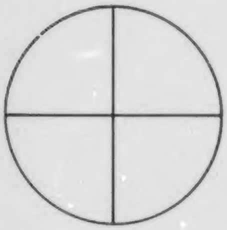
    Quotient = ________________ workers

BASIC MATH
UNIT II

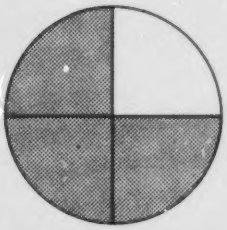
ASSIGNMENT SHEET #11 — WORK WITH FRACTIONS

NAME ____ SCORE ________________

When something is divided into parts that are all of equal size, it is divided into fractional parts. For example, the circle below is divided into four fractional parts.



To talk about fractional parts, you use fractions. For example, one of the four parts of the circle is unshaded, or $^{1}/_{4}$ of the circle is unshaded; three of the four parts of the circle are shaded, or $^{3}/_{4}$ of the circle is shaded.



In the fraction $^{3}/_{4}$, the 4 is called the *denominator.* It shows the number of equal parts into which the circle is divided. The 3 is called the *numerator.* It shows the number of parts that are used.

1. Identify the numerator and denominator of each of the following problems by filling in the blanks.
   a. In the fraction $^{5}/_{7}$, the numerator is ________ and the denominator is ________
   b. In the fraction $^{8}/_{18}$, 8 is the ________________ and 18 is the ________________
   c. In the fraction $^{1}/_{3}$, what is the numerator? ________ denominator? ________
2. Write fractions which fit the following statements.
   a. A fraction with a denominator of 17 and numerator of 10 __________________
   b. A fraction with a numerator of 16 and a denominator of 37 __________________

ASSIGNMENT SHEET #11

3. A worker cuts a quarry tile into 8 equal pieces and then destroys 1 of the 8 pieces.

   a. Which number represents the numerator? ______________________

   b. Which number represents the denominator? ______________________

   c. What fractional part of the tile did the worker destroy? ______________________

4. Match each of the following fractions with the correctly shaded figures. Write the correct number in the blanks. There are more figures than there are fractions.

______a. 4/8

______b. 2/2

______c. 6/16

______d. 3/7

______e. 5/5

______f. 1/2

______g. 2/7

______h. 5/6

______i. 1/4

______j. 2/3

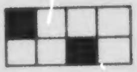
______k. 7/8

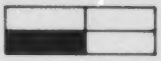
______l. 3/5

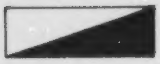
______m. 2/8

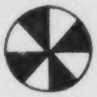
______n. 3/3

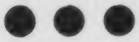
______o. 1/5

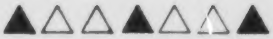
1. 

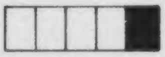
2. 

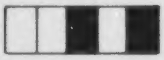
3. 

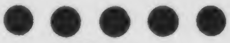
4. 

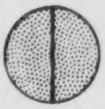
5. 

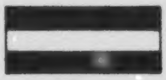
6. 

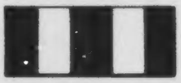
7. 

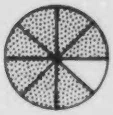
8. 

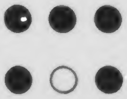
9. 

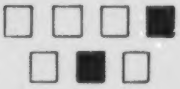
10. 

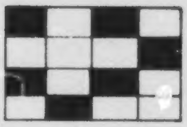
11. 

12. 

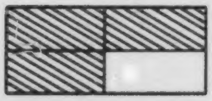
13. 

14. 

15. 

16. 

5. Draw a suitable figure to represent each of the following fractions.

EXAMPLE: $\frac{3}{4}$ 

a. 1/2

ASSIGNMENT SHEET #11

b. 3/4

c. 2/3

d. 1/4

e. 7/8

f. 5/16

g. 3/3

h. 2/4

i. 3/8

j. 13/16

BASIC MATH
UNIT II

ASSIGNMENT SHEET #12 — USE FRACTIONS AND NUMBERS

NAME ____ SCORE ______________

A fraction such as $^{3}/_{4}$ is called a *proper fraction.* This is because the numerator (top number) is smaller than the denominator (bottom number). Some examples of proper fractions are $^{2}/_{3}$, $^{1}/_{5}$, and $^{7}/_{8}$.

When the numerator of a fraction is the same, or larger, than the denominator, the fraction is called an *improper fraction.* Some examples of improper fractions are $^{4}/_{4}$, $^{5}/_{3}$, $^{9}/_{4}$, and $^{10}/_{8}$.

Numbers such as $2^{1}/_{2}$, $5^{3}/_{4}$, and $6^{2}/_{5}$ are called *mixed numbers.* They are made up of a whole number and a fraction.

1. Distinguish among the following fractions by placing "P" for proper fraction, "I" for improper fraction, or "M" for mixed number in the blank to the left.

______a. $^{1}/_{2}$
______b. $^{7}/_{8}$
______c. $^{16}/_{2}$
______d. $3^{1}/_{8}$
______e. $^{1}/_{4}$
______f. $^{1}/_{1}$
______g. $^{7}/_{3}$
______h. $8^{1}/_{3}$
______i. $^{4}/_{4}$
______j. $9^{2}/_{3}$
______k. $5^{1}/_{2}$
______l. $^{9}/_{8}$
______m. $^{9}/_{9}$
______n. $^{1}/_{7}$
______o. $16^{3}/_{4}$

2. Use the following denominators and fill in numerators to complete the following problems.

   a. Complete the following to make proper fractions.

      1) $/_{8}$
      2) $/_{10}$
      3) $/_{7}$
      4) $/_{2}$
      5) $/_{30}$

ASSIGNMENT SHEET #12

b. Complete the following to make improper fractions.

1) $/_{3}$

2) $/_{5}$

3) $/_{6}$

4) $/_{9}$

5) $/_{4}$

3. Convert each of the following mixed numbers to improper fractions. (Do not reduce answers to lowest terms at this time.)

a. $3^{1}/_{4}$ = ______

b. $4^{1}/_{2}$ = ______

c. $7^{1}/_{3}$ = ______

d. $8^{1}/_{2}$ = ______

e. $6^{2}/_{3}$ = ______

f. $5^{1}/_{5}$ = ______

g. $4^{2}/_{3}$ = ______

h. $8^{1}/_{7}$ = ______

i. $9^{1}/_{5}$ = ______

j. $16^{2}/_{3}$ = ______

k. $2^{1}/_{2}$ = ______

l. $3^{2}/_{4}$ = ______

m. $7^{3}/_{4}$ = ______

n. $9^{2}/_{3}$ = ______

o. $5^{2}/_{3}$ = ______

p. $6^{1}/_{8}$ = ______

q. $3^{3}/_{4}$ = ______

r. $6^{4}/_{5}$ = ______

s. $4^{1}/_{3}$ = ______

t. $1^{4}/_{5}$ = ______

4. Convert each of the following improper fractions to mixed numbers. (Do not reduce answers to lowest terms at this time.)

a. ${}^{16}/_{5}$ = ______

b. ${}^{12}/_{5}$ = ______

c. ${}^{17}/_{3}$ = ______

d. ${}^{8}/_{3}$ = ______

e. ${}^{9}/_{2}$ = ______

f. ${}^{5}/_{3}$ = ______

g. ${}^{7}/_{2}$ = ______

h. ${}^{9}/_{4}$ = ______

i. ${}^{17}/_{16}$ = ______

j. ${}^{11}/_{5}$ = ______

ASSIGNMENT SHEET #12

k. $19/13$ = ______

l. $8/7$ = ______

m. $75/32$ = ______

n. $24/17$ = ______

o. $13/9$ = ______

p. $7/4$ = ______

q. $9/8$ = ______

r. $4/3$ = ______

s. $15/4$ = ______

t. $18/7$ = ______

BASIC MATH
UNIT II

ASSIGNMENT SHEET #13 — REDUCE FRACTIONS TO LOWEST TERMS

NAME ______________________________ SCORE ______________

Fractions are "reduced" to their lowest terms so that they are more readily understood or recognized. For example $^{1}/_{2}$ is more easily recognized than $^{16}/_{32}$.

To reduce a fraction to lowest terms, divide the numerator and the denominator by the largest divisor that is common to both.

EXAMPLES:

$$\frac{18 \div 2}{24 \div 2} = \frac{9}{12}$$

$$\frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

1. a. $^{3}/_{9}$ = ______
   b. $^{8}/_{24}$ = ______
   c. $^{10}/_{15}$ = ______
   d. $^{15}/_{25}$ = ______
   e. $^{12}/_{48}$ = ______
   f. $^{9}/_{24}$ = ______
   g. $^{5}/_{7}$ = ______
   h. $^{2}/_{4}$ = ______
   i. $^{9}/_{12}$ = ______
   j. $^{50}/_{1004}$ = ______

2. a. $^{5}/_{5}$ = ______
   b. $^{8}/_{12}$ = ______
   c. $^{7}/_{21}$ = ______
   d. $^{4}/_{8}$ = ______
   e. $^{10}/_{12}$ = ______
   f. $^{26}/_{52}$ = ______
   g. $^{6}/_{9}$ = ______
   h. $^{13}/_{39}$ = ______
   i. $^{9}/_{9}$ = ______
   j. $^{12}/_{16}$ = ______

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BASIC MATH
UNIT II

ASSIGNMENT SHEET #14 — FIND COMMON DENOMINATORS

NAME ____________________________________ SCORE ______________

If the denominators are different in addition or subtraction of fractions, the fractions must be changed to equivalent fractions with a common denominator.

To change a fraction to its equivalent with a higher denominator, multiply the denominator of the given fraction by the number that will give the desired denominator; then multiply the numerator of the fraction by the same multiplier.

EXAMPLE: $\frac{1}{2} = \frac{\_}{8} \qquad \frac{1 \times 4}{2 \times 4} = \frac{4}{8} \qquad \frac{1}{2} = \frac{4}{8}$

To change a fraction to its equivalent with a lower denominator, proceed in like manner, but divide both the denominator and the numerator by the same number.

EXAMPLE: $\frac{12}{16} = \frac{\_}{4} \qquad \frac{12 \div 4}{16 \div 4} = \frac{3}{4} \qquad \frac{12}{16} = \frac{3}{4}$

PART I

Convert each of the following fractions to equivalent fractions with a common denominator.

1. a. $^{1}/_{2} = \;/_{12}$
   b. $^{2}/_{3} = \;/_{12}$
   c. $^{3}/_{4} = \;/_{12}$
   d. $^{5}/_{6} = \;/_{12}$

2. a. $^{1}/_{4} = \;/_{32}$
   b. $^{5}/_{8} = \;/_{32}$
   c. $^{7}/_{8} = \;/_{32}$
   d. $^{9}/_{16} = \;/_{32}$

3. a. $^{12}/_{16} = \;/_{4}$
   b. $^{18}/_{24} = \;/_{4}$
   c. $^{24}/_{32} = \;/_{4}$
   d. $^{42}/_{56} = \;/_{4}$

4. a. $^{15}/_{48} = \;/_{16}$
   b. $^{25}/_{80} = \;/_{16}$
   c. $^{28}/_{64} = \;/_{16}$
   c. $^{18}/_{32} = \;/_{16}$

ASSIGNMENT SHEET #14

PART II

Fractions that have the same denominator are said to have a common denominator.

EXAMPLE: Find common denominator of $\frac{5}{6}$ and $\frac{3}{8}$

Common denominator of $\frac{5}{6}$ and $\frac{3}{8}$ is 24, a common multiple of 6 and 8.

Find the lowest common denominator for each group of fractions.

1. $^{7}/_{8}$ $^{5}/_{12}$ $^{3}/_{16}$ $^{17}/_{24}$ = __________
2. $^{3}/_{5}$ $^{5}/_{6}$ $^{9}/_{10}$ $^{4}/_{15}$ = __________
3. $^{1}/_{2}$ $^{5}/_{12}$ $^{2}/_{3}$ $^{3}/_{4}$ = __________
4. $^{3}/_{4}$ $^{5}/_{6}$ $^{12}/_{24}$ $^{40}/_{36}$ = __________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #15 — ADD FRACTIONS

NAME ______________________________ SCORE ______________

To add common fractions, change to equivalent fractions with common denominators. Add the new numerators and place this sum over the common denominator. If the result is an improper fraction, change it to a mixed number and reduce to lowest terms.

EXAMPLE: $\frac{2}{3} + \frac{3}{4} = \frac{8}{12} + \frac{9}{12}$

$= \frac{17}{12}$

$= 1\frac{5}{12}$

Find common denominators and add the following fractions. Reduce to lowest terms.

1. a. $^{1}/_{4} + ^{2}/_{3} =$ ________ e. $^{3}/_{4} + ^{5}/_{6} =$ ________

b. $^{4}/_{5} + ^{3}/_{4} =$ ________ f. $^{5}/_{8} + ^{5}/_{6} =$ ________

c. $^{5}/_{9} + ^{4}/_{7} =$ ________ g. $^{2}/_{5} + ^{4}/_{9} =$ ________

d. $^{7}/_{12} + ^{5}/_{8} =$ ________ h. $^{3}/_{5} + ^{2}/_{3} =$ ________

ASSIGNMENT SHEET #15

2. If 1/2 gallon of liquid latex is added to 3/4 gallon of water, what is the total amount of liquid?

   Total = ________________ gallons

3. If it takes 15 minutes (1/4 hour) to lay out a counter top and 55 minutes (11/12 hour) to install the tile, how many hours did the job require?

   Total = ________________ hours

4. If a tile is 3/16" thick and setting material is applied 1/8" thick, what height above the surface is the top of the tile?

   Total = ________________ inch

5. If a tile setter has 1/3 of a gallon of organic adhesive left over from a job, how many gallons will there be if the tilesetter mixes it with 1/2 gallon left over from another job?

   Total = ________________ gallons

6. A piece of tile must be cut so that it is 47/64" wide. If the width of the cut is 1/16", what is the total width of tile removed?

   Total = ________________ inch

ASSIGNMENT SHEET #15

7. A certain cleaning solution requires mixing two chemicals with water. If the solution requires 1/5 gallon of one chemical and 2/3 gallon of the second chemical, how much solution is produced when the chemicals are added to 3/4 gallon of water?

Total = ________________ gallons

BASIC MATH
UNIT II

ASSIGNMENT SHEET #16 — SUBTRACT FRACTIONS

NAME ______________________________ SCORE ______________

To subtract fractions, change to equivalent fractions with common denominators. Find the difference between the numerators of the equivalent fractions. Place the difference over the common denominator and, if necessary, reduce the answer to lowest terms.

EXAMPLE: $\frac{2}{3} - \frac{1}{4} = \frac{8}{12} - \frac{3}{12}$

$= \frac{5}{12}$

Subtract each of the following common fractions. Reduce to lowest terms.

1. a. $3/4 - 2/3 =$ __________ e. $5/9 - 3/8 =$ __________

b. $7/8 - 2/3 =$ __________ f. $2/3 - 1/2 =$ __________

c. $4/5 - 5/12 =$ __________ g. $4/5 - 3/8 =$ __________

d. $5/6 - 5/8 =$ __________ h. $9/10 - 2/3 =$ __________

ASSIGNMENT SHEET #16

i. $6/7 - 5/9 =$ ________ j. $1/3 - 5/16 =$ ________

2. A tile setter uses $1/2$ gallon of grout from a pail which had $2/3$ gallon in it. How much grout is left?

   Difference = ________________ gallon

3. A worker spends $7/8$ of the workday installing tile and cleaning up. If $1/16$ of the time is spent cleaning up, how much of the day is spent installing tile?

   Difference = ________________ workday

4. A space of $13/16$" is left between the tile that has been set and the wall. If you allow $1/4$" for grout, how wide should the cut piece be to fit the space?

   Difference = ________________ inch

5. A tile setter estimated that a job would take 45 minutes ($3/4$ hour). Laying out the job took 10 minutes ($1/6$ hour). What part of an hour is left for completing the job within the estimate?

   Difference = ________________ hour

ASSIGNMENT SHEET #16

6. After one day, a crew had finished $1/3$ of a job. By the end of the second day, they had completed $3/5$ of the total job. How much of the job is left to be done on the third day?

Difference = ________________ job

BASIC MATH
UNIT II

ASSIGNMENT SHEET #17 — ROUND OFF DECIMALS

NAME ____ SCORE ________________

Often it is more convenient to work with approximate decimal values when exact accuracy is not required. To determine the approximate value you must round off the number to the required decimal place. If the number after the required decimal place is 4 or less you simply drop the numbers to the right of the required decimal place.

EXAMPLE: Round 3.1416 off to hundredths

3.14

If the number after the required decimal place is 5 or more, add 1 to the required decimal place and drop the numbers to the right.

EXAMPLE: Round 3.1416 off to thousandths

3.142

1. Round the following numbers to the nearest tenth.

   a. 1.4733 = ______________

   b. 521.181 = ______________

   c. 0.11103 = ______________

   d. 57.99 = ______________

   e. 127.006 = ______________

2. Round the following numbers to the nearest hundredth.

   a. 27.6363 = ______________

   b. 0.0170 = ______________

   c. 14.607 = ______________

   d. 39.382 = ______________

   e. 1.11171 = ______________

ASSIGNMENT SHEET #17

3. Round the following number to the nearest thousandth.

   a. 131.0034 = ______________

   b. 0.174836 = ______________

   c. 94.6888 = ______________

   d. 9.0997 = ______________

   e. 43.0101 = ______________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #18 — SOLVE ADDITION PROBLEMS WITH DECIMALS

NAME ______________________________ SCORE ______________

You can add decimals just as you add whole numbers. You must be careful, though, to keep all decimal points in a straight line.

Add each of the following columns of numbers, carrying when necessary. Place a decimal point in the sum directly under the decimal points above.

EXAMPLES:

0.26 + 0.168 0.428	4.607 + .408 5.015

1. a. 0.024 + 0.165	b. 0.873 + 0.199	c. 4.6 + 4.62	d. 0.0003 + 0.0099
e. 5.00 + 0.99	f. 4.5 + 0.008	g. 62.14 + 8.87	h. 3.487 + 9.645
i. 0.5 0.6 + 8.3	j. 195.7 83. + 9.006	k. 21.5 18.9 + 32.8	l. 0.0131 0.1640 + 0.2229
m. 8.69 3.07 + 17.50	n. 4.612 0.958 + 0.885	o. 5.29 4.38 + 9.62	p. 72.24 16.38 + 92.37
q. 1986.45 312.45 + 1000.98	r. 4937.23 4980.47 10234.97 + 9872.21	s. 0.52802 0.34007 0.00321 + 0.00009	t. 15.125 4.625 20.125 + 16.125

ASSIGNMENT SHEET #18

2. A tile contractor purchased the following materials for a job: 62 bags of cement, $74.40; 21 cu yds of sand, $73.50; and 94 sq ft of tile, $77.08. What did his materials cost?

Total = ____________________ dollars

3. If upon completion of a job, a contractor paid the following amounts to the various mechanics and subcontractors who assisted in the work, how much was the total amount paid?

Z.D. Smith	$146.35
C.M. Jones	95.00
R.D. Morton	49.36
Bill Koch	46.75
Charles Cameron	637.42
Roosevelt Brown	46.31

Total = ____________________ dollars

4. A contractor has a bank balance of $16,457.68. The contractor receives the following checks for contracts completed: $531.56, $787.90, $134.68, $6,537.84, $654.45. What will the balance be after these are deposited?

Total = ____________________ dollars

ASSIGNMENT SHEET #18

5. If a tile setter worked the following number of hours each day, how many hours were worked in the week?

Monday	8.25 hours
Tuesday	9.10 hours
Wednesday	8.55 hours
Thursday	8.10 hours
Friday	9.25 hours

Total = ____________________ hours

6. To determine the average thickness of a brand of tile, a company selected ten tiles at random and measured each one with the results shown below. The process required that they total the thicknesses of the ten tiles. What should their total have been?

#1 = .1258"
#2 = .1273"
#3 = .1244"
#4 = .12"
#5 = .1262"
#6 = .124"
#7 = .1244"
#8 = .125"
#9 = .13"
#10 = .128"

Total = ____________________ inches

BASIC MATH
UNIT II

ASSIGNMENT SHEET #19 — SOLVE SUBTRACTION PROBLEMS WITH DECIMALS

NAME ______________________ SCORE __________

When you subtract decimals, decimal points must be kept in a straight line.

EXAMPLE:

$$\begin{array}{r} 416.09 \\ -\ \ 79.88 \\ \hline 336.21 \end{array}$$

1. Rewrite each of the following problems in column form. Subtract and check your work.

   a. 868.87 – 516.89 = ______________

   b. 567 – 19.856 = ______________

   c. 198 – 56.987 = ______________

   d. 567.94 – 59.78 = ______________

   e. $815.23 – $65.98 = ______________

ASSIGNMENT SHEET #19

f. $20.03 – $15.88 = ____________________

g. 694.7 – 24.3 = ____________________

h. 5,000 – 892.66 = ____________________

i. $15 – $12.53 = ____________________

j. 219.3 – 0.085 = ____________________

k. 16.78 – 5.99 = ____________________

ASSIGNMENT SHEET #19

l. 1.6 - 0.9453 = ____________________

m. 2.345 - 1.6 = ____________________

n. 0.13 - 0.023 = ____________________

o. 0.00754 - 0.00093 = ____________________

p. 20.32 - 0.84 = ____________________

q. 930 - 17.45 = ____________________

ASSIGNMENT SHEET #19

r. 0.034 – 0.034 = ____________________

s. 1 – 0.9999 = ____________________

t. 7.777 – 0.777 = ____________________

2. An original bid of $50,527.30 was reduced by $7,428.36 because of certain omissions on the job. What was the cost of the job?

   Difference = ____________________ dollars

3. A bid of $5,320.50 was reduced to $4,750.45 by changing some materials. How much was the difference?

   Difference = ____________________ dollars

ASSIGNMENT SHEET #19

4. A room to be tiled has 287.6 sq ft of floor with a column in the middle of the room. If the column takes 3.9 sq ft, how much surface area must be tiled?

   Difference = ____________________ square feet

5. A sheet of back-mounted mosaic tiles has a thickness of .1337". If the tiles are .1202" thick, how thick is the paper backing?

   Difference = ____________________ inch

6. A contractor received $16,281.43 for doing a job. What was the contractor's profit if expenses for the job consisted of $8,219.66 for labor, $3,221.17 for materials, and $436.81 for other expenses?

   Difference = ____________________

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BASIC MATH
UNIT II

ASSIGNMENT SHEET #20 — SOLVE MULTIPLICATION PROBLEMS WITH DECIMALS

NAME ______________________________ SCORE ______________

You must be careful where you place the decimal point when you multiply numbers containing decimals. The number of decimal places in an answer must equal the total number of decimal places in the numbers that you multiplied.

EXAMPLE:

$$\begin{array}{rl} 16.11 & \text{— 2 decimal places} \\ \times \quad 2.2 & \text{— 1 decimal place} \\ \hline 3222 & \\ 3222 & \\ \hline 35.442 & \text{— 3 decimal places in answer} \end{array}$$

Rewrite the following problems in column form and multiply. Locate the decimal point correctly in the product.

1. a. 2.64 × 3.1 = ____________________

   b. 120 × 0.33 = ____________________

   c. 26.4 × 0.51 = ____________________

   d. 35 × 8.5 = ____________________

   e. 26.4 × 3.8 = ____________________

ASSIGNMENT SHEET #20

f. 7.02 × 0.92 = ____________________

g. 0.83 × 0.55 = ____________________

h. 28.2 × 0.9 = ____________________

i. 0.069 × 0.01 = ____________________

j. 7.52 × 3.01 = ____________________

k. 32.1 × 29.9 = ____________________

l. 0.168 × 12 = ____________________

m. 78 × 9.1 = ____________________

ASSIGNMENT SHEET #20

n. 69.3 × 0.75 = ____________________

o. 0.043 × 2.4 = ____________________

p. 574 × 0.34 = ____________________

q. 10.52 × 0.54 = ____________________

r. 9.06 × 4.3 = ____________________

s. 21.6 × 0.3 = ____________________

t. 60.1 × 8.2 = ____________________

ASSIGNMENT SHEET #20

2. What is the cost of one dozen margin trowels at $8.80 each and one dozen grouting trowels at $6.00 each?

Product = ____________________ dollars

3. A tile contractor employed 6 tile setters. Each one worked 40 hours in one week. Their wage scale was $12.84 per hour. What was the amount of the payroll?

Product = ____________________ dollars

4. If one square foot of glazed tile requires an average of 16 tiles, find the approximate number for 32.5 sq ft.

Product = ____________________ tiles

5. Each 4¼" × 4¼" tile covers .125 square feet. How many square feet can be covered by 25 tiles?

Product = ____________________ square feet

6. A requested pattern of tile costs $3.62 per square foot. How much will it cost to buy enough tile to cover 81.04 sq ft?

Product = ____________________ dollars

ASSIGNMENT SHEET #20

7. A company pays time-and-a-half for work done on Saturdays. If a worker normally gets paid $11.73 per hour, how much will that worker earn per hour on Saturday?

Product = ____________________ dollars

8. If a 6" × 6" quarry tile covers .25 sq ft, how much area will a shipment of 691 such tiles cover?

Product = ____________________ square feet

9. A tile setter averages installing 27.4 sq ft of tile per hour. How many square feet can the worker install in one week of working 42.75 hours?

Product = ____________________ square feet

10. If an 8" × 8" quarry tile covers .44 sq ft, how much area will 439 such tiles cover?

Product = ____________________ square feet

11. If a tile setter earns $12.66 per hour and averages 7.96 hours per day, how much will the worker earn in 5 days?

Product = ____________________ dollars

BASIC MATH
UNIT II

ASSIGNMENT SHEET #21 — SOLVE DIVISION PROBLEMS WITH DECIMALS

NAME ____ SCORE ________________

Division with decimals is like division with whole numbers. However, before you begin to divide, you must decide where the decimal point should be placed in the number.

First study the divisor. If the divisor is a decimal, move the decimal point to the right so that you change the divisor to a whole number. Then move the decimal point the same number of places to the right in the dividend.

EXAMPLES: Decimal point moved 1 place in both numbers.

$$\begin{array}{l} \underset{\curvearrowright}{.2.}\overline{)\,\underset{\curvearrowright}{.\dot{4}.}} \\ \quad 4. \\ \quad \underline{4} \\ \quad 0 \end{array} \qquad\qquad \begin{array}{r} 2. \\ 2.\overline{)\,4.} \end{array}$$

Decimal point moved 2 places in both numbers.

$$\underset{\curvearrowright}{.14.}\overline{)\,\underset{\curvearrowright}{14.02.}\!8} \qquad\qquad \begin{array}{r} 100.2 \\ 14.\overline{)\,1402.8} \\ \underline{14} \\ 0028 \\ \underline{28} \\ 0 \end{array}$$

Decimal point moved 1 place in both numbers; note that a zero had to be added.

$$\underset{\curvearrowright}{1.3.}\overline{)\,\underset{\curvearrowright}{26.\dot{0}.}} \qquad\qquad \begin{array}{r} 20. \\ 13.\overline{)\,260.} \\ \underline{26} \\ 0 \end{array}$$

No decimal point was moved to the right because 3 is already a whole number.

$$3\overline{)\,\dot{.}6} \qquad\qquad \begin{array}{r} .2 \\ 3\overline{)\,.6} \\ \underline{6} \\ 0 \end{array}$$

ASSIGNMENT SHEET #21

Divide the following problems. Show your work. Check your answers.

1. a. 4.5 ÷ 0.5 = ________

   b. 4.92 ÷ 0.4 = ________

   c. 19.8 ÷ 0.6 = ________

   d. 10.71 ÷ 0.07 = ________

   e. 0.225 ÷ 0.15 = ________

   f. 1.7608 ÷ 0.0062 = ________

   g. 0.48 ÷ 0.6 = ________

ASSIGNMENT SHEET #21

h. 0.125 ÷ 0.25 = ________

i. 0.9 ÷ 0.003 = ________

j. 1.16 ÷ 2.9 = ________

k. 75 ÷ 0.03 = ________

l. 108 ÷ 0.09 = ________

m. 84 ÷ 0.007 = ________

n. 459 ÷ 2.7 = ________

ASSIGNMENT SHEET #21

o. 64 ÷ 0.16 = ________

p. 125 ÷ 0.25 = ________

q. 34 ÷ 8.5 = ________

r. 6 ÷ 0.12 = ________

s. 406 ÷ 0.029 = ________

t. 8433 ÷ 0.09 = ________

2. A house with a floor area of 1,728 sq ft cost $73,872.00 dollars. What was the cost per square foot?

Quotient = ____________________ dollars

ASSIGNMENT SHEET #21

3. One item on a bid was $6,270 for labor. If the hourly rate was $9.75, how many hours was the job expected to take?

Quotient = ____________________ hours

4. A certain bullnose tile is 4.25 inches, including the joint. How many tiles are required for a job 850 inches in length?

Quotient = ____________________ tiles

5. Instructions for mixing a cleaning solution indicate that industrial tile cleaner should be mixed with water to produce a solution which is 25% tile cleaner. How much solution can be made with 3.5 gallons tile cleaner?

Quotient = ____________________ gallons

6. If a carton of 125 tiles costs $121.25, what is the cost per tile?

Quotient = ____________________ dollars

BASIC MATH
UNIT II

ASSIGNMENT SHEET #22 — WRITE FRACTIONS AS DECIMALS AND PERCENTAGES

NAME ______________________________ SCORE ________________

In practical math, percentage is often useful. Percent means "per hundredths." Five percent means "five one-hundredths" and may be written three ways: $^{5}/_{100}$, 0.05, and 5%. All have the same mathematical value.

1. Express each of the following fractions as a decimal. You may refer to the table of Transparency #2.

EXAMPLE: $\frac{1}{5}$

$$\begin{array}{r} 0.20 \\ 5\overline{)1.00} \\ \underline{1\,0} \\ 0 \\ \underline{0} \end{array}$$

a. $^{1}/_{8}$ = __________

b. $^{1}/_{4}$ = __________

c. $^{1}/_{2}$ = __________

d. $^{3}/_{4}$ = __________

e. $^{5}/_{8}$ = __________

f. $^{3}/_{8}$ = __________

g. $^{7}/_{16}$ = __________

h. $^{13}/_{16}$ = __________

i. $^{15}/_{32}$ = __________

j. $^{3}/_{32}$ = __________

ASSIGNMENT SHEET #22

2. Match the decimal notations on the right to their correct equivalent fractions. Write the correct numbers of the matching answers in the blanks.

______a.	$5\ ^{6}/_{10}$		1.	7.083
______b.	$1\ ^{2}/_{100}$		2.	5.006
______c.	$^{87}/_{1000}$		3.	78.3
______d.	$7\ ^{83}/_{1000}$		4.	0.087
______e.	$5\ ^{6}/_{100}$		5.	0.783
______f.	$5\ ^{6}/_{1000}$		6.	87.7
______g.	$78\ ^{3}/_{10}$		7.	51.4
______h.	$87\ ^{7}/_{10}$		8.	102.0
______i.	102		9.	5.06
______j.	$^{783}/_{1000}$		10.	1.02

3. Write the following numbers in decimal notation.

a. $63\ ^{9}/_{10}$ = ______________

b. $5\ ^{93}/_{100}$ = ______________

c. $5\ ^{93}/_{1000}$ = ______________

d. $5\ ^{93}/_{10000}$ = ______________

ASSIGNMENT SHEET #22

e. $3\ {}^{825}/_{1000}$ = ______________

f. $38\ {}^{95}/_{100}$ = ______________

g. $38\ {}^{95}/_{1000}$ = ______________

h. $42\ {}^{3}/_{10}$ = ______________

i. $402\ {}^{3}/_{10}$ = ______________

j. $897\ {}^{97}/_{1000000}$ = ______________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #23 — WRITE DECIMALS AND FRACTIONS AS PERCENTAGES

NAME ______________________________ SCORE ______________

It is sometimes necessary to write decimals and fractions as percentages. Remember that a percentage is just fractional parts of 100.

EXAMPLES: 0.24 = 24%

$^{1}/_{10} = {}^{10}/_{100} = 10\%$

$^{1}/_{4} = {}^{25}/_{100} = 25\%$

1. Express each of the following decimals as a percentage.

   a. 0.17 = ______________

   b. 0.7366 = ______________

   c. 1.832 = ______________

   d. 0.001 = ______________

   e. 4.0921 = ______________

2. Express each of the following fractions as a percentage.

   (NOTE: Carry to three decimal places.)

   EXAMPLE: $\frac{1}{5}$

$$\begin{array}{r} 0.20 \\ 5\overline{)1.00} \\ \underline{1\,0} \\ 0 \\ \underline{0} \end{array} \quad = 20\%$$

   a. $^{1}/_{4}$ = ______________

   b. $^{3}/_{4}$ = ______________

   c. $^{2}/_{2}$ = ______________

   d. $^{1}/_{3}$ = ______________

   e. $^{5}/_{8}$ = ______________

ASSIGNMENT SHEET #23

3. Express each of the following fractions as a percentage.

a. $^{27}/_{100}$ = ____________

b. $^{3}/_{100}$ = ____________

c. $^{7}/_{10}$ = ____________

d. $^{14}/_{100}$ = ____________

e. $^{9}/_{10}$ = ____________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #24 — WRITE PERCENTAGES AS FRACTIONS AND DECIMALS

NAME ________________________________ SCORE ______________

In some cases it could be necessary to write given percentages as fractions or decimals. Remembering that percent means "per hundredths" is helpful.

EXAMPLES:

$$20\% = \frac{20}{100} = \frac{1}{5}$$

$$20\% = .20$$

1. Express each of the following percentages as a fraction.

   a. 50% = ________

   b. 25% = ________

   c. 33.33% = ________

   d. 36% = ________

   e. 21% = ________

   f. 45% = ________

   g. 66.66% = ________

   h. 70% = ________

2. Express each of the following percentages as a decimal.

   a. 47% = ________

   b. 15% = ________

   c. 33.3% = ________

   d. 62% = ________

   e. 75% = ________

   f. 3% = ________

ASSIGNMENT SHEET #24

g. 16.8% = ________

h. 9% = ________

i. 10% = ________

j. 50% = ________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #25 — SOLVE PERCENTAGE PROBLEMS

NAME ______________________ SCORE __________

In this assignment sheet, percentages are used in situations that represent actual job incidents. Solve each of the following percentage problems.

1. What does it mean to say 100% of the work is completed? ______________________

   ____

2. There are usually 100 tools in the tool crib. Fourteen of them are missing. What percent of the tools is missing? ______________________

3. If 14 of the tools are missing in the above problem, how many are present? ______________ What percent is present? ______________

4. There are 100 tiles in a box. Twenty-five tiles are what percent of the tiles in the box?

   ____

5. There are 100 jobs scheduled for completion in 1984. Ninety-four have been completed. What percent of the jobs has been completed? ______________________

6. If 94 of the jobs in the above problem have been completed, how many have not been?

   ____

   What percent has not been completed? ______________________

7. If 11% of the workers on a job are absent, what percent is present? ______________

ASSIGNMENT SHEET #25

8. If 6% of the tiles that a store had in stock were not sold, what percent was sold?

____

9. If 60% of the homes in town had ceramic tile, what percent did not have ceramic tile?

____

10. Byrl has a set of trowels. Ten percent of his trowels are a year old, and 40% are over a year old. What percent is less than a year old? _______________________

11. Susan has three sizes of levels — 18″, 24″, and 36″. Eighty percent of her levels are 18″, and 15% are 24″. What percent is 36″? ___________________________

12. Peter, a beginning tile setter, spent 22% of his income for a van, 17% for hand tools, 15% for work clothes, and 8% for miscellaneous equipment. What percent was left for other things? ____

13. Chester has finished 75% of the tile installation he is doing. What percent does he still have to do? ____

14. Betty has completed 40% of her installation. What percent does she still have to do?

____

15. If you were told to complete 93% of the work, what percent would be left? ________

BASIC MATH
UNIT II

ASSIGNMENT SHEET #26 — FIND PERCENTAGES OF WHOLE NUMBERS

NAME ____________________ SCORE __________

Finding percentages of whole numbers is a math operation that can be used by a tile setter. Find the following percentages of whole numbers. Carry out your answers to two decimal places and round off if necessary.

EXAMPLES: 20 is what percent of 80?

$$\frac{20}{80} = \frac{x}{100}$$

$$80x = 2000$$

$$x = 25\%$$

20% of 45 is what number?

$$\frac{20}{100} = \frac{x}{45}$$

$$100x = 900$$

$$x = 9.00$$

15 is 25% of what number?

$$\frac{15}{x} = \frac{25}{100}$$

$$25x = 1500$$

$$x = 60$$

Solve each of the following problems.

1. a. 3% of 72 is what number? ________

   b. 5% of 18 is what number? ________

ASSIGNMENT SHEET #26

c. What number is 33.33% of 96? ________

d. 40% of 125 is what number? ________

e. 68% of 63.5 is what number? ________

f. What number is 12.5% of 140.8? ________

g. What number is 1% of 103? ________

h. What number is 27.5% of 152? ________

i. 50% of 32.8 is what number? ________

j. 7% of 163 is what number? ________

ASSIGNMENT SHEET #26

Solve each of the following word problems. Show your work.

2. There are 20 students in a class. Sixty percent of the students are boys. How many are boys? ____________________

3. One day 5% of the 20 tile mechanics in Mr. Moore's group made perfect time completing a job. How many operators made perfect time? ____________________

4. Contractor McGill bought a new tile saw — regularly selling for $120 — at a sale and saved 20%. How much did he save? ____________________

5. The number of contractors at the meeting this week was 75% of what it was last week. Last week there were 800 contractors at the meeting. How many contractors were at the meeting this week? ____________________

ASSIGNMENT SHEET #26

6. Thirty-three and one-third percent of 150 safety forms have been filled out. How many forms have been filled out? ____________________

7. What is 75% of 20? ____________________

8. On one day only 65 percent of the 120 students in Highland Trade School were present. How many students were present? ____________________

9. One tile setter always adds 15% to material estimates to cover breakage. How many square feet of extra tile will be ordered if the estimated amount is 1232 sq ft? ____________________ square feet

ASSIGNMENT SHEET #26

10. Terry is a tile setter who is just getting started. To build up a good tool collection, Terry uses 12 percent of each week's paycheck to buy tools. How much money will Terry have to spend on tools if last week's pay check was $437.84 ____________________

11. The owner of Adkins Tile Co. bids jobs to allow for a profit of 20% over costs. Additionally, Mr. Adkins sets aside 8% of all profits in a fund for employee profit-sharing. If the company makes 20% profit on a job which costs $29,135.90, how much money will go into the profit-sharing fund? ____________________

BASIC MATH
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1.	a.	8	2.	a.	10
	b.	11		b.	5
	c.	7		c.	9
	d.	10		d.	12
	e.	8		e.	4
	f.	5		f.	9
	g.	4		g.	2
	h.	6		h.	11
	i.	2		i.	7
	j.	11		j.	12
	k.	16		k.	5
	l.	11		l.	8
	m.	7		m.	11
	n.	17		n.	13

3. 25 feet

4. 16 feet

5. 15 cartons

Assignment Sheet #2

1.	a.	157	2.	a.	151	3.	a.	135
	b.	177		b.	191		b.	157
	c.	207		c.	148		c.	127
	d.	157		d.	174		d.	139
	e.	164		e.	135		e.	167

ANSWERS TO ASSIGNMENT SHEETS

4. a. 360
   b. 370
   c. 310
   d. 340
   e. 319

5. a. 334
   b. 439
   c. 469
   d. 410
   e. 434

6. 152 square feet

7. 193 square feet

8. 115 gallons

9. 80 cartons

10. 142 lineal inches

Assignment Sheet #3

1. a. 2606
   b. 2283
   c. 2269
   d. 3387
   e. 1838
   f. 2946
   g. 941
   h. 1471

2. 1748 square feet

3. 1143 hours

4. 520 lineal feet

5. 1731 square feet

Assignment Sheet #4

1. a. 5
   b. 1
   c. 3
   d. 3
   e. 2

2. a. 3
   b. 6
   c. 6
   d. 0
   e. 6

3. a. 3
   b. 0
   c. 2
   d. 2
   e. 3

ANSWERS TO ASSIGNMENT SHEETS

f.	6	f.	4	f.	7
g.	1	g.	6	g.	7
h.	2	h.	4	h.	4
i.	1	i.	1	i.	6
j.	0	j.	9	j.	3
k.	7	k.	8	k.	7
l.	2	l.	1	l.	7
m.	0	m.	4	m.	7
n.	3	n.	1	n.	7

4. 7 lineal feet
5. 21 tiles
6. 7 pounds
7. 3 rooms
8. 4 hours
9. 9 colors
10. 8 hours

Assignment Sheet #5

1.	a.	19	2.	a.	99	3.	a.	48
	b.	27		b.	327		b.	33
	c.	1448		c.	482		c.	38
	d.	2639		d.	14		d.	56
4.	a.	32	5.	a.	4528			
	b.	126		b.	156			
	c.	178		c.	1830			
	d.	199		d.	5338			

ANSWERS TO ASSIGNMENT SHEETS

6. 217 square feet
7. 43 lineal feet
8. 36 miles
9. 910 pounds
10. 314 tiles

Assignment Sheet #6

1. a. 12
   b. 0
   c. 18
   d. 0
   e. 8
   f. 0
   g. 20
   h. 72
   i. 42
   j. 24
   k. 16
   l. 24
   m. 4
   n. 9

2. a. 30
   b. 36
   c. 6
   d. 12
   e. 5
   f. 81
   g. 25
   h. 12
   i. 27
   j. 48
   k. 30
   l. 24
   m. 12
   n. 27

3. a. 27
   b. 15
   c. 18
   d. 21
   e. 49
   f. 56
   g. 32
   h. 40
   i. 54
   j. 10
   k. 36
   l. 2
   m. 15
   n. 64

4. a. 24
   b. 45
   c. 25
   d. 49
   e. 40

5. a. 16
   b. 32
   c. 64
   d. 36
   e. 56

ANSWERS TO ASSIGNMENT SHEETS

f.	63	f.	81
g.	40	g.	72
h.	63	h.	40
i.	48	i.	49
j.	54	j.	9
k.	42	k.	42
l.	18	l.	36
m.	10	m.	40
n.	48	n.	35

Assignment Sheet #7

1.	a.	212	2.	a.	684	3.	a.	19470	4.	a.	3367
	b.	96		b.	2265		b.	3609		b.	22548
	c.	104		c.	624		c.	9684		c.	17024
	d.	328		d.	3515		d.	25515		d.	5448
	e.	228		e.	1977		e.	30492		e.	31473

5. 1,575 square feet
6. 750 trim tiles
7. 1233 square feet
8. 630 pounds
9. $58,569
10. 22,440 square feet

Assignment Sheet #8

1.	a.	2394	2.	a.	7030	3.	a.	308024
	b.	6460		b.	5130		b.	929071
	c.	1888		c.	2881		c.	50304

ANSWERS TO ASSIGNMENT SHEETS

- d. 4032
- e. 4672
- f. 4482

- d. 4928
- e. 6314
- f. 6633

- d. 274995
- e. 640791
- f. 395605

4. 1,466,088 pounds
5. 9,464 cartons
6. 1575 tiles
7. 11,397 square feet
8. 42,968 tiles
9. 2,299 hours
10. 333,396 square feet

Assignment Sheet #9

1. a. 2
   b. 3
   c. 45
   d. 600
2. a. 1
   b. 4
   c. 12
   d. 9
3. a. 13
   b. 510
   c. 12
   d. 17
4. a. 7
   b. 107
   c. 12
   d. 91
5. a. 166
   b. 1117
   c. 412
   d. 31
6. 25 square feet
7. 102 tiles
8. 9 sheets
9. 231 square feet
10. 21 pieces

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #10

1. a. 2
   b. 3
   c. 3
2. a. 4
   b. 12
   c. 8
3. a. 12
   b. 11
   c. 3
4. a. 9
   b. 15
   c. 20
5. a. 25
   b. 8
   c. 4
6. a. 327, R 5
   b. 124, R 51
   c. 186, R 4
7. a. 175 b. 492 c. 258
8. a. 255 b. 136 c. 327
9. a. 721, R 2 b. 604 c. 1606
10. a. 302 b. 2010 c. 7013
11. a. 507 b. 280 c. 3120
12. 381 miles
13. 1437 square feet
14. 151 square feet
15. 54 cartons
16. 34 pounds
17. 9.5 days
18. 183 gallons
19. 753 cartons
20. 11 workers

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #11

1. a. 5, 7
   b. numerator, denominator
   c. 1, 3
2. a. $^{10}/_{17}$
   b. $^{16}/_{37}$
3. a. 1
   b. 8
   c. $^{1}/_{8}$
4. a. 4
   b. 10
   c. 16
   d. 6
   e. 9
   f. 3
   g. 15
   h. 14
   i. 2
   j. 11
   k. 13
   l. 12
   m. 1
   n. 5
   o. 7
5. Evaluated to the satisfaction of the instructor

Assignment Sheet #12

1. a. P
   b. P
   c. I
   d. M
   e. P
   f. I
   g. I
   h. M
   i. I
   j. M
   k. M
   l. I
   m. I
   n. P
   o. M
2. Answers may vary
   a. Evaluated to the satisfaction of the instructor
   b. Evaluated to the satisfaction of the instructor

ANSWERS TO ASSIGNMENT SHEETS

3.	a.	$^{13}/_{4}$	f.	$^{26}/_{5}$	k.	$^{5}/_{2}$	p.	$^{49}/_{8}$
	b.	$^{9}/_{2}$	g.	$^{14}/_{3}$	l.	$^{14}/_{4}$	q.	$^{15}/_{4}$
	c.	$^{22}/_{3}$	h.	$^{57}/_{7}$	m.	$^{31}/_{4}$	r.	$^{34}/_{5}$
	d.	$^{17}/_{2}$	i.	$^{46}/_{5}$	n.	$^{29}/_{3}$	s.	$^{13}/_{3}$
	e.	$^{20}/_{3}$	j.	$^{50}/_{3}$	o.	$^{17}/_{3}$	t.	$^{9}/_{5}$
4.	a.	$3^{1}/_{5}$	f.	$1^{2}/_{3}$	k.	$1^{6}/_{13}$	p.	$1^{3}/_{4}$
	b.	$2^{2}/_{5}$	g.	$3^{1}/_{2}$	l.	$1^{1}/_{7}$	q.	$1^{3}/_{6}$
	c.	$5^{2}/_{3}$	h.	$2^{1}/_{4}$	m.	$2^{11}/_{32}$	r.	$1^{1}/_{3}$
	d.	$2^{2}/_{3}$	i.	$1^{1}/_{16}$	n.	$1^{7}/_{17}$	s.	$3^{3}/_{4}$
	e.	$4^{1}/_{2}$	j.	$2^{1}/_{5}$	o.	$1^{4}/_{9}$	t.	$2^{2}/_{7}$

Assignment Sheet #13

1.	a.	$^{1}/_{3}$	f.	$^{3}/_{8}$	2.	a.	1	f.	$^{1}/_{2}$
	b.	$^{1}/_{3}$	g.	$^{5}/_{7}$		b.	$^{2}/_{3}$	g.	$^{2}/_{3}$
	c.	$^{2}/_{3}$	h.	$^{1}/_{2}$		c.	$^{1}/_{3}$	h.	$^{1}/_{3}$
	d.	$^{3}/_{5}$	i.	$^{3}/_{4}$		d.	$^{1}/_{2}$	i.	1
	e.	$^{1}/_{4}$	j.	$^{1}/_{2}$		e.	$^{5}/_{6}$	j.	$^{3}/_{4}$

Assignment Sheet #14

PART I

1.	a.	6	2.	a.	8	3.	a.	3	4.	a.	5
	b.	8		b.	20		b.	3		b.	5
	c.	9		c.	28		c.	3		c.	7
	d.	10		d.	18		d.	3		d.	9

PART II

1. 48
2. 30

ANSWERS TO ASSIGNMENT SHEETS

3. 12
4. 72

Assignment Sheet #15

1. a. $\frac{11}{12}$
   b. $1\frac{11}{20}$
   c. $1\frac{8}{63}$
   d. $1\frac{5}{24}$
   e. $1\frac{7}{12}$
   f. $1\frac{11}{24}$
   g. $\frac{38}{45}$
   h. $1\frac{4}{15}$
2. $1\frac{1}{4}$ gallons
3. $1\frac{1}{6}$ hours
4. $\frac{5}{16}$ inch
5. $\frac{5}{6}$ gallons
6. $\frac{51}{64}$ inch
7. $1\frac{37}{60}$ gallons

Assignment Sheet #16

1. a. $\frac{1}{12}$
   b. $\frac{5}{24}$
   c. $\frac{23}{60}$
   d. $\frac{5}{24}$
   e. $\frac{13}{72}$
   f. $\frac{1}{6}$
   g. $\frac{17}{40}$
   h. $\frac{7}{30}$
   i. $\frac{19}{63}$
   j. $\frac{1}{48}$
2. $\frac{1}{6}$ gallon
3. $\frac{13}{16}$ workday
4. $\frac{9}{16}$ inch
5. $\frac{7}{12}$ hour
6. $\frac{1}{15}$ job

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #17

1. a. 1.5
   b. 521.2
   c. 0.1
   d. 58.0
   e. 127.0

2. a. 27.64
   b. 0.02
   c. 14.61
   d. 39.38
   e. 1.11

3. a. 131.003
   b. 0.175
   c. 94.689
   d. 9.100
   e. 43.010

Assignment Sheet #18

1. a. 0.189
   b. 1.072
   c. 9.22
   d. 0.0102
   e. 5.99
   f. 4.508
   g. 71.01
   h. 13.132
   i. 9.4
   j. 287.706
   k. 73.2
   l. 0.4000
   m. 29.26
   n. 6.455
   o. 19.29
   p. 180.99
   q. 3299.88
   r. 30024.88
   s. 0.87139
   t. 56.000
2. $224.98
3. $1,021.19
4. $25,104.11

ANSWERS TO ASSIGNMENT SHEETS

5. 43.25 hours
6. 12.551 inches

Assignment Sheet #19

1.
   - a. 351.98
   - b. 547.144
   - c. 141.013
   - d. 508.16
   - e. $749.25
   - f. $4.15
   - g. 670.4
   - h. 4107.34
   - i. $2.47
   - j. 219.215
   - k. 10.79
   - l. 0.6547
   - m. 0.745
   - n. 0.107
   - o. 0.00661
   - p. 19.48
   - q. 912.55
   - r. 0
   - s. 0.0001
   - t. 7.000
2. $43,098.94
3. $570.05
4. 283.7 square feet
5. 0.0135 inch
6. $4403.79

Assignment Sheet #20

1.
   - a. 8.184
   - b. 39.6
   - c. 13,464
   - d. 297.5
   - e. 100.32
   - f. 6.4584
   - g. 0.4565
   - h. 25.38
   - i. 0.00069
   - j. 22.6352
   - k. 959.79
   - l. 2.016
   - m. 709.8
   - n. 51.975
   - o. 0.1032
   - p. 195.16
   - q. 5.6808
   - r. 38.958
   - s. 6.48
   - t. 492.82
2. $177.60
3. $3,081.60
4. 520 tiles
5. 3.125 square feet
6. $293.37
7. $17.60
8. 172.75 square feet

ANSWERS TO ASSIGNMENT SHEETS

9. 1171.35 square feet
10. 193.16 square feet
11. $503.90 or $503.87

Assignment Sheet #21

1. a. 9.0
   b. 12.3
   c. 33.0
   d. 153.0
   e. 1.5
   f. 284.0
   g. 0.8
   h. 0.5
   i. 300.0
   j. 0.31
   k. 2500.0
   l. 1200.0
   m. 12000.0
   n. 170.0
   o. 400.0
   p. 500.0
   q. 4.0
   r. 50.0
   s. 14000.0
   t. 97700.0
2. 42.75 dollars
3. 643.078 hours
4. 200 tiles
5. 14 gallons
6. .97 dollars

Assignment Sheet #22

1. a. 0.125
   b. 0.25
   c. 0.5
   d. 0.75
   e. 0.625
   f. 0.375
   g. 0.4375
   h. 0.8125
   i. 0.46875
   j. 0.09375

2. a. 7
   b. 10
   c. 4
   d. 1
   e. 9
   f. 2
   g. 3
   h. 6
   i. 8
   j. 5

ANSWERS TO ASSIGNMENT SHEETS

3. a. 63.9
   b. 5.93
   c. 5.093
   d. 5.0093
   e. 3.825
   f. 38.95
   g. 38.095
   h. 42.3
   i. 402.3
   j. 897.00097

Assignment Sheet #23

1. a. 17%
   b. 73.66%
   c. 183.2%
   d. 0.1%
   e. 409.21%

2. a. 25%
   b. 75%
   c. 100%
   d. 33.333%
   e. 62.5%

3. a. 27%
   b. 30%
   c. 70%
   d. 1.4%
   e. 90%

Assignment Sheet #24

1. a. 1/2
   b. 1/4
   c. 1/3
   d. 9/25
   e. 21/100
   f. 9/20
   g. 2/3
   h. 7/10

ANSWERS TO ASSIGNMENT SHEETS

2. a. 0.47
   b. 0.15
   c. 0.333
   d. 0.62
   e. 0.75
   f. 0.03
   g. 0.168
   h. 0.09
   i. 0.10
   j. 0.50

Assignment Sheet #25

1. All work is completed
2. 14%
3. 86 - 86%
4. 25%
5. 94%
6. 6 - 6%
7. 89%
8. 94%
9. 40%
10. 50%
11. 5%
12. 38%
13. 25%
14. 60%
15. 7%

Assignment Sheet #26

1. a. 2.16
   b. 0.9
   c. 32
   d. 50
   e. 43.18
   f. 17.6
   g. 1.03
   h. 41.8
   i. 16.4
   j. 11.41

2. 12
3. 1
4. $24.00
5. 600
6. 50
7. 15
8. 78
9. 184.8 square feet
10. $52.54
11. $466.17 or $466.18

BASIC MATH
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match terms associated with basic math to their correct definitions. Write the correct numbers in the blanks.

_____a. To solve by mathematical process

_____b. First integer

_____c. An abbreviated process of adding an integer to itself a specified number of times

_____d. Positive or negative whole number

_____e. Opposite (inverse) operation of multiplication

_____f. Mathematical proposition

_____g. Any one of the ten symbols, 0 to 9, by which all numbers may be expressed

_____h. Part of a whole; represents one or more equal parts of a unit

_____i. Mark made to indicate where something is to be inserted

_____j. Fractions based on the number 10; not written as common fractions

_____k. Outer limits or boundary

_____l. One part in a hundred; reckoned on the basis of a whole divided into one hundred parts

_____m. Bracket used to enclose dividend in a division problem

_____n. Opposite (inverse) operation of addition

1. Integer
2. Caret
3. Division
4. Digit
5. Calculate
6. Decimals
7. Subtraction
8. Fraction
9. Problem
10. Multiplication
11. Percent
12. Unit
13. Frame
14. Perimeter

TEST

2. Select from the following list reasons that math is important to the tile setter. Write an "X" in the blank before each correct answer.

_____a. To figure total costs when unit costs are known

_____b. To keep a record of materials used on job

_____c. To solve problems when figuring the layout and backing board spacing

_____d. To plumb and square work

_____e. To figure total tile amounts when unit amounts are known

3. Label the following math problems with their correct math function terms.

a.
632.9 1) ________________
127.4 2) ________________
+ 311.5 3) ________________
1071.8 4) ________________

b.
471.8 1) ________________
− 250.0 2) ________________
221.8 3) ________________

c.
455.5 1) ________________
× 54.4 2) ________________
18220 3) ________________
18220 4) ________________
22775 5) ________________
24779.20 6) ________________

d. 1) ________________

```
    284 1.     2) ________________
2.5)7103.5     3) ________________
    50
    210
    200
     103
     100
      35
      25
      10       4) ________________
```

TEST

4. Match symbols used in math problems to their correct descriptions. Write the correct numbers in the blanks.

_____a. Addition
_____b. Subtraction
_____c. Division
_____d. Multiplication
_____e. Equal
_____f. Decimal
_____g. Percent
_____h. Caret

1. ÷
2. .
3. =
4. %
5. +
6. ∧
7. ×
8. −

5. Solve the following addition problems.

a.	b.	c.	d.
1	35	114	2706
9	10	241	4521
3	25	305	5134
+ 5	+ 70	+ 422	+ 7250

e. If a tile contractor needed 163 sacks of cement for one job, 79 sacks for a second job, 239 sacks for a third, and 29 sacks for a fourth job, how many total sacks should be purchased?

Total = ____________________ sacks

6. Solve the following subtraction problems.

a.	b.	c.	d.
9	87	1711	39082
− 3	− 52	− 504	− 8151

TEST

e. A tile contractor estimated that a job would require 1638 days to complete. The actual job took 1716 days. How many days of labor were lost?

Difference = ____________________ days

7. Solve the following multiplication problems.

a. $\begin{array}{r} 212 \\ \times\ \ 3 \\ \hline \end{array}$ b. $\begin{array}{r} 42 \\ \times\ 21 \\ \hline \end{array}$ c. $\begin{array}{r} 178 \\ \times\ 141 \\ \hline \end{array}$ d. $\begin{array}{r} 1147 \\ \times\ \ 319 \\ \hline \end{array}$

e. What is the cost of a tile job in a home containing 279 square feet of tile if the cost per square foot is $8.00?

Product = ____________________ dollars

8. Solve the following division problems.

a. $22\overline{)88}$ b. $42\overline{)320}$ c. $452\overline{)1087}$ d. $641\overline{)16754}$

e. How many abrasive tiles are there if one out of every four tiles in the floor is an abrasive tile and the tile floor contains 7360 tiles?

Quotient = ____________________ tiles

9. Distinguish among types of fractions.

a. Write a "P" in the blanks before proper fractions, an "I" before improper fractions, and an "M" in the blanks before mixed numbers.

______ 1) $^1/_3$

______ 2) $8^1/_5$

______ 3) $^7/_7$

______ 4) $15^2/_3$

______ 5) $5^2/_7$

______ 6) $^{10}/_{25}$

______ 7) $^2/_5$

______ 8) $6^1/_2$

______ 9) $^1/_4$

______ 10) $^{99}/_1$

TEST

b. Write a "C" in the blanks before common fractions and a "U" in the blanks before uncommon fractions.

______ 1) $^{1}/_{16}$ and $^{7}/_{16}$

______ 2) $^{7}/_{12}$ and $^{1}/_{4}$

______ 3) $^{1}/_{4}$ and $^{1}/_{6}$

______ 4) $^{3}/_{8}$ and $^{5}/_{8}$

______ 5) $^{2}/_{7}$ and $^{2}/_{5}$

10. Convert the following mixed numbers to improper fractions.

a. $3^{1}/_{2}$ = ____________________

b. $4^{2}/_{4}$ = ____________________

c. $3^{6}/_{9}$ = ____________________

d. $12^{4}/_{6}$ = ____________________

e. $13^{13}/_{39}$ = ____________________

11. Reduce the following fractions to lowest terms.

a. $^{4}/_{10}$ = ____________________

b. $^{6}/_{12}$ = ____________________

c. $^{7}/_{14}$ = ____________________

d. $^{6}/_{14}$ = ____________________

e. $^{13}/_{50}$ = ____________________

f. $^{4}/_{16}$ = ____________________

g. $^{2}/_{16}$ = ____________________

h. $^{8}/_{10}$ = ____________________

i. $^{12}/_{16}$ = ____________________

j. $^{121}/_{132}$ = ____________________

TEST

12. Find the lowest common denominator for each group of fractions.

a. $^{1}/_{4}$ $^{7}/_{10}$ = ________

b. $^{1}/_{2}$ $^{2}/_{3}$ = ________

c. $^{1}/_{2}$ $^{2}/_{9}$ $^{2}/_{3}$ = ________

d. $^{2}/_{7}$ $^{2}/_{3}$ $^{1}/_{6}$ = ________

e. $^{5}/_{12}$ $^{3}/_{5}$ $^{1}/_{6}$ = ________

13. Add the following fractions. Reduce your answer to lowest terms.

a. $^{1}/_{8} + ^{5}/_{8} =$ ________________

b. $^{1}/_{16} + ^{15}/_{16} =$ ________________

c. $^{2}/_{3} + ^{3}/_{3} =$ ________________

d. $^{1}/_{2} + ^{4}/_{8} =$ ________________

e. $^{4}/_{5} + ^{2}/_{3} =$ ________________

f. $^{7}/_{8} + ^{6}/_{9} =$ ________________

g. $2^{1}/_{3} + 7^{1}/_{7} =$ ________________

h. $3^{2}/_{4} + 16^{1}/_{5} =$ ________________

i. $4^{2}/_{7} + 8^{2}/_{3} =$ ________________

j. $5^{1}/_{5} + 6^{2}/_{6} =$ ________________

TEST

14. Subtract the following fractions. Reduce your answer to lowest terms.

a. $\frac{4}{5} - \frac{3}{5} =$ ____________________

b. $\frac{6}{8} - \frac{2}{8} =$ ____________________

c. $\frac{9}{13} - \frac{4}{13} =$ ____________________

d. $\frac{3}{6} - \frac{1}{3} =$ ____________________

e. $\frac{3}{8} - \frac{1}{3} =$ ____________________

f. $\frac{14}{16} - \frac{7}{8} =$ ____________________

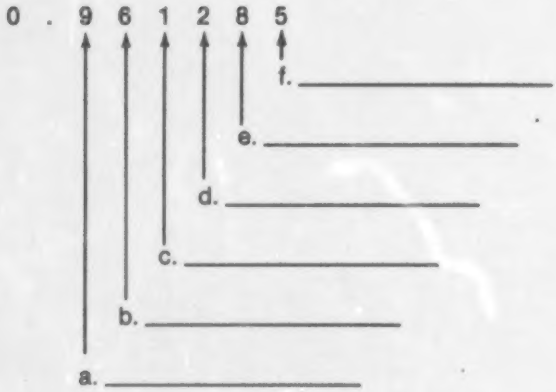
g. $2\frac{3}{4} - 1\frac{1}{4} =$ ____________________

h. $6\frac{1}{3} - 2\frac{1}{2} =$ ____________________

i. $9\frac{2}{5} - 4\frac{1}{2} =$ ____________________

j. $12\frac{6}{8} - 7\frac{1}{3} =$ ____________________

15. Write the place value of each of the decimals in the number 0.961285 below.



TEST

16. Round off the following decimals to hundredths.

a. 23.037 = ____________________

b. 18.391 = ____________________

c. 5.0507 = ____________________

d. 8.130 = ____________________

e. 11.2993 = ____________________

17. Add the following decimals. Write in column form.

a. 3.5 + 5.1 + 7 = ____________________

b. 3.4 + 0.206 + 1.75 = ____________________

TEST

c. 6.86 + 0.0505 + 7.9 + 82 = ____________________

d. 57.78 + 0.22 + 0.003 + 74 = ____________________

e. 6319 + 95.12 + 0.0713 + 321.07 = ____________________

18. Subtract the following decimals. Check your work.

a. 6.103 − 2.209 = ____________________

b. 5.400 − 2.322 = ____________________

TEST

c. 7.38 - 0.063 = ____________________

d. 0.835325 - 0.25 = ____________________

e. 0.609375 - 0.359375 = ____________________

19. Multiply the following decimals.

a. 2.6 × 4.7 = ____________________

b. 0.119 × 0.05 = ____________________

c. 9 × 0.8 = ____________________

TEST

d. $7.392 \times 92.07 =$ ____________________

e. $9.5 \times 0.76 =$ ____________________

20. Divide the following whole numbers and decimals using decimals. Check your work.

a. $5.32 \div 0.4 =$ ____________________

b. $83.4 \div 0.6 =$ ____________________

c. $0.765 \div 0.5 =$ ____________________

d. $0.921 \div 0.3 =$ ____________________

TEST

e. 0.0225 ÷ 0.15 = ____________________

f. 24 ÷ 0.2 = ____________________

g. 54 ÷ 0.09 = ____________________

h. 63 ÷ 0.007 = ____________________

i. 812 ÷ 0.058 = ____________________

j. 4215 ÷ 0.040 = ____________________

TEST

21. Convert the following fractions to decimals and percentages.

a. $^{1}/_{3}$ = ____________________ f. 0.31 = ____________________

b. $^{3}/_{25}$ = ____________________ g. 0.125 = ____________________

c. $^{7}/_{16}$ = ____________________ h. 4.33 = ____________________

d. $^{2}/_{7}$ = ____________________ i. 0.1 = ____________________

e. $^{5}/_{8}$ = ____________________ j. 9.75 = ____________________

22. Convert the following decimals and fractions to percentages.

a. 0.61 = ____________________ f. $^{1}/_{100}$ = ____________________

b. 2.13 = ____________________ g. $^{2}/_{25}$ = ____________________

c. 0.171 = ____________________ h. $^{9}/_{32}$ = ____________________

d. 4.206 = ____________________ i. $2^{2}/_{3}$ = ____________________

e. 0.0173 = ____________________ j. $^{3}/_{4}$ = ____________________

TEST

23. Convert the following percentages to fractions and decimals.

a. 12% = ____________________ or ____________________

b. 30% = ____________________ or ____________________

c. 45% = ____________________ or ____________________

d. 72% = ____________________ or ____________________

e. 250% = ____________________ or ____________________

24. Solve the following percentage problems.

a. If a motor with 150 horsepower runs with 87 percent efficiency, how much horsepower does it deliver? ______________________________

b. If 27% of a setting material placed in storage becomes useless, how many gallons will be left of 2100 gallons placed in storage? ____________________

TEST

c. If a contractor bought a storage building for $24,000, and sold it for $30,000, what would be the percentage of profit? ____________________

BASIC MATH
UNIT II

ANSWERS TO TEST

1.	a.	5	h.	8
	b.	12	i.	2
	c.	10	j.	6
	d.	1	k.	14
	e.	3	l.	11
	f.	9	m.	13
	g.	4	n.	7

2. a, b, c, d, e

3.	a.	1)	Addend	b.	1)	Minuend
		2)	Addend		2)	Subtrahend
		3)	Addend		3)	Difference
		4)	Sum or total			
	c.	1)	Multiplicand	d.	1)	Divisor
		2)	Multiplier		2)	Quotient
		3)	Partial product		3)	Dividend
		4)	Partial product		4)	Remainder
		5)	Partial product			
		6)	Product			

4.	a.	5	e.	3
	b.	8	f.	2
	c.	1	g.	4
	d.	7	h.	6

ANSWERS TO TEST

5. a. 18
b. 140
c. 1,082
d. 19,611
e. 510

6. a. 6
b. 35
c. 1,207
d. 30,931
e. 78

7. a. 636
b. 882
c. 25,098
d. 365,893
e. $2,232.00

8. a. 4
b. 7, R 26
c. 2, R 183
d. 26, R 88
e. 1,840

ANSWERS TO TEST

9. a.
1) P
2) M
3) I
4) M
5) M
6) P
7) P
8) M
9) P
10) I

b.
1) C
2) C
3) U
4) C
5) U

10. a. $^{7}/_{2}$
b. $^{18}/_{4}$
c. $^{33}/_{9}$
d. $^{76}/_{6}$
e. $^{520}/_{39}$

11. a. $^{2}/_{5}$
b. $^{2}/_{3}$
c. $^{1}/_{2}$
d. $^{4}/_{7}$
e. $^{6}/_{25}$
f. $^{1}/_{4}$
g. $^{1}/_{8}$
h. $^{4}/_{5}$
i. $^{3}/_{4}$
j. $^{11}/_{12}$

12. a. 20
b. 6
c. 18
d. 42
e. 60

ANSWERS TO TEST

13.	a.	$\frac{3}{4}$	f.	$1\frac{13}{24}$
	b.	1	g.	$9\frac{10}{21}$
	c.	$1\frac{2}{3}$	h.	$19\frac{7}{10}$
	d.	1	i.	$12\frac{20}{21}$
	e.	$1\frac{7}{15}$	j.	$11\frac{8}{15}$
14.	a.	$\frac{1}{5}$	f.	0
	b.	$\frac{1}{2}$	g.	$1\frac{1}{2}$
	c.	$\frac{5}{13}$	h.	$3\frac{5}{8}$
	d.	$\frac{1}{8}$	i.	$4\frac{9}{10}$
	e.	$\frac{1}{24}$	j.	$5\frac{5}{12}$

15. a. Tenths
b. Hundredths
c. Thousandths
d. Ten-thousandths
e. Hundred-thousandths
f. Millionths

16. a. 23.04
b. 18.39
c. 5.05
d. 8.13
e. 11.30

17. a.
$$\begin{array}{r} 3.5 \\ 5.1 \\ 7.0 \\ \hline 15.6 \end{array}$$

b.
$$\begin{array}{r} 3.400 \\ 0.206 \\ 1.750 \\ \hline 5.356 \end{array}$$

c.
$$\begin{array}{r} 6.8600 \\ 0.0505 \\ 7.9000 \\ 82.0000 \\ \hline 96.8105 \end{array}$$

d.
$$\begin{array}{r} 57.780 \\ 00.220 \\ 00.003 \\ 74.000 \\ \hline 132.003 \end{array}$$

e.
$$\begin{array}{r} 6319.0000 \\ 0095.1200 \\ 0000.0713 \\ 0321.0700 \\ \hline 6735.2613 \end{array}$$

ANSWERS TO TEST

18. a. 3.894
b. 3.078
c. 7.317
d. 0.585325
e. 0.25

19. a. 12.22
b. 0.00595
c. 7.2
d. 680.58144
e. 7.22

20. a. 13.3
b. 139
c. 1.53
d. 3.07
e. 0.15
f. 120.
g. 600.
h. 9000.
i. 14000.
j. 105375.

21. a. 0.3333
b. 0.12
c. 0.4375
d. 0.2857
e. 0.8333
f. $^{31}/_{100}$
g. $^{1}/_{8}$
h. $4^{1}/_{3}$
i. $^{1}/_{10}$
j. $9^{3}/_{4}$

ANSWERS TO TEST

22. a. 61%
    b. 213%
    c. 17.1%
    d. 420.6%
    e. 1.73%
    f. 1%
    g. 8%
    h. 28.125%
    i. 266.67%
    j. 75%

23. a. $^{3}/_{25}$, 0.12
    b. $^{3}/_{10}$, 0.30
    c. $^{9}/_{20}$, 0.45
    d. $^{18}/_{25}$, 0.72
    e. $^{5}/_{2}$, 2.50

24. a. 130.50 horsepower
    b. 1848 gallons
    c. 20%

TOOLS
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to correctly select tools and equipment used to complete tile setting tasks. The student should also be able to demonstrate proper and safe use and care of tools. This knowledge will be shown by completing assignment sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with tools used by the tile setter.
2. Select from a list rules for proper and safe use and care of tools.
3. Name frequently used layout and leveling tools.
4. Match to their correct definitions selected tools used by tile setter in layout and leveling.
5. Name basic cutting and drilling tools used by tile setter.
6. Match to their correct uses selected cutting and drilling tools used by tile setter.
7. Identify parts of a tile cutter.
8. Identify parts of a tile saw.
9. Identify selected trowels used by tile setter.
10. Match to their correct uses selected trowels used by tile setter.
11. Match to their correct uses selected mortar tools used by tile setter.
12. Match to their correct uses special tools and basic equipment used by tile setter.
13. Label selected tools used by tile setter.
14. Make a list of tools and equipment needed to begin tile setting trade.
15. Calculate cost of tools needed by beginning tile setter.
16. Demonstrate the ability to
    a. Use nippers.
    b. Use tile cutter.

OBJECTIVE SHEET

c. Use tile saw.

d. Use electric drill.

e. Use a level.

TOOLS
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Provide students with objective sheet.

  B. Discuss unit and specific objectives.

  C. Provide students with information, assignment, and job sheets.

  D. Discuss information and assignment sheets.

  E. Set up a display of tools used by tile setters.

  (NOTE: If possible, select tools for display that are of varying quality and condition.)

  F. Provide tool catalogs so that students may complete Assignment Sheet #3.

  G. Stress the importance of care and cleaning of tools used by tile setters.

  H. Demonstrate and discuss procedures outlined in job sheets.

  I. Give test after students have completed unit and assignments.

II. Instructional materials

  A. Objective sheet

  B. Suggested activities

  C. Information sheet

  D. Assignment sheets

    1. Assignment Sheet #1--Identify Selected Tools Used by Tile Setter

    2. Assignment Sheet #2--Make a List of Tools and Equipment Needed to Begin Tile Setting Trade

    3. Assignment Sheet #3--Calculate Cost of Tools Needed by Beginning Tile Setter

  E. Answers to assignment sheets

  F. Job sheets

    1. Job Sheet #1--Use Nippers

    2. Job Sheet #2--Use Tile Cutter

SUGGESTED ACTIVITIES

3. Job Sheet #3--Use Tile Saw

4. Job Sheet #4--Use Electric Drill

5. Job Sheet #5--Use a Level

G. Test

H. Answers to test

III. Unit references

A. *Ceramic Tile Manual*. Los Angeles: Building News, Inc., 1979.

B. *Tile Setting Workbook*. Sacramento: California State Department of Education, 1975.

TOOLS
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Lath--Metal mesh which acts as a background or reinforcing agent for the scratch or mortar coat

   (NOTE: "Lath" also refers to wood strips used as a background for gypsum plaster.)

   B. Grout--Modified portland cement or noncement based material used for filling tile joints

   C. Butter--To spread a bond coat on the back of a ceramic tile just before the tile is placed

   D. Flush--Even or unbroken line or surface; being even or on the same line or plane

II. Rules for proper and safe use and care of tools

   A. Select high quality tools

   B. Purchase sufficient number of tools

   C. Replace lost or damaged tools

   D. Lay tools down carefully in a safe place to prevent damage

   (NOTE: Not only will handling tools properly prevent damage to the tools but also to floors, walls, and work area.)

   E. Always use precautions to protect finished surfaces from damage by tools

   F. Clean all tools and equipment before storing them

   G. Avoid dropping tools

   H. Keep tools sharp

   I. Check notched trowels and replace if worn

   J. Keep light bulbs enclosed in wire protectors while in use

   K. Avoid immersing wooden tool handles in water for extended periods of time

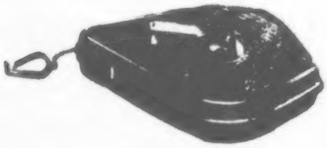
   L. Use tools only for jobs for which they are intended

INFORMATION SHEET

III. Frequently used layout and leveling tools (Figures 1-6; Assignment Sheets #1 and #2)

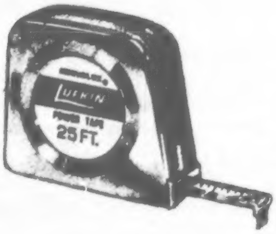
A. Chalk line

FIGURE 1



B. Steel measuring tape

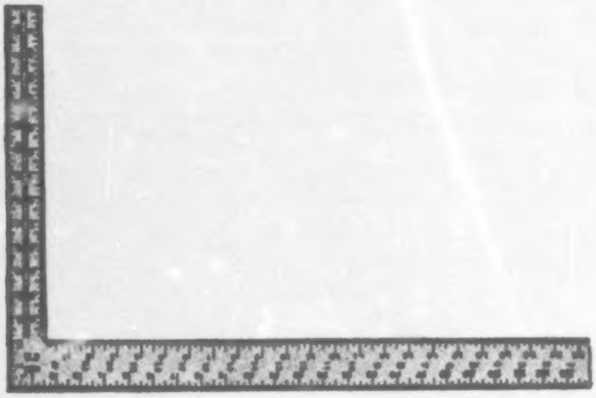
FIGURE 2


LUFKIN
POWER TAPE
25 FT.

INFORMATION SHEET

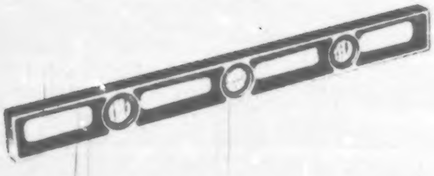
C. Steel square

FIGURE 3



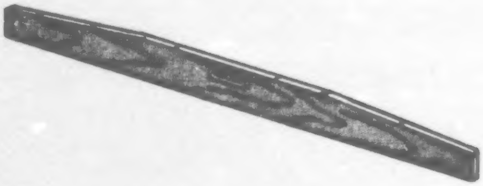
D. Level

FIGURE 4



E. Straightedge

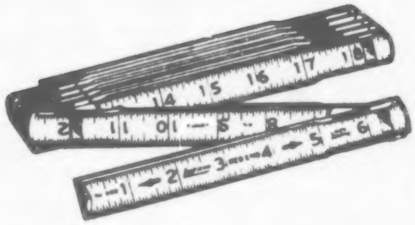
FIGURE 5



INFORMATION SHEET

F. Wood folding rule

FIGURE 6



IV. Uses of selected tools used by tile setter in layout and leveling

A. Chalk line--Used for laying down working, finish, plumb, and level lines

B. Steel measuring tape--Used to measure floors, walls, and other relatively long distances

C. Steel square--Used to square tile layouts

(NOTE: The steel square is one of the most important tilesetting tools.)

D. Level--Used to draw level starting and field lines and to level curbs and door jambs

E. Straightedge--Used to spread or level thick-bed mortar; also placed on starting line and used as a straightedge against which to butt tile rows

F. Wood folding rule--Used to measure tile cuts and other relatively short distances

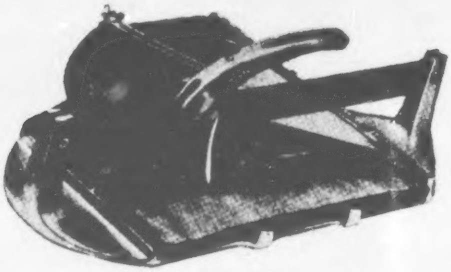
(NOTE: Some tile setters use a steel measuring tape.)

INFORMATION SHEET

V. Basic cutting and drilling tools used by tile setter (Figures 7-23; Assignment Sheets #1 and #2)

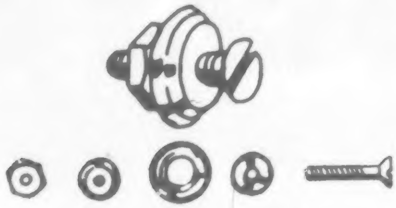
A. Tile cutter

FIGURE 7



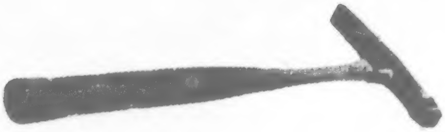
B. Carbide wheel assembly

FIGURE 8



C. Chipping hammer

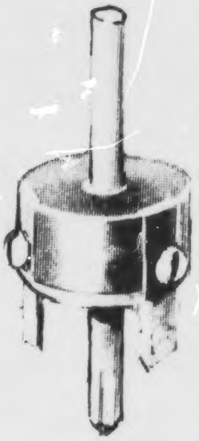
FIGURE 9



INFORMATION SHEET

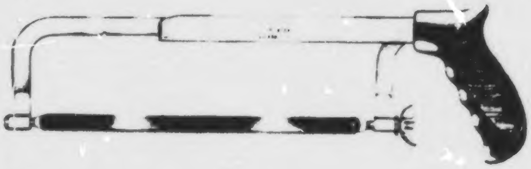
D. Hole saw

FIGURE 10



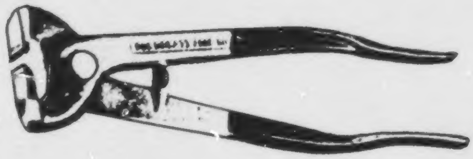
E. Hacksaw

FIGURE 11



F. Nippers

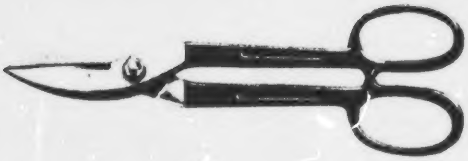
FIGURE 12



INFORMATION SHEET

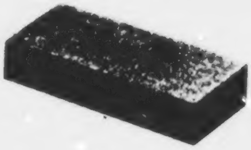
G. Tin snips

FIGURE 13



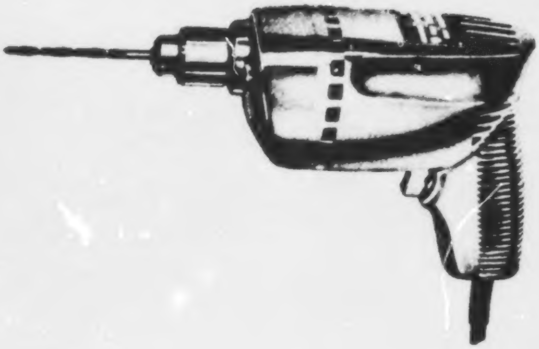
H. Rub stone (rub brick)

FIGURE 14



I. Electric drill and bit

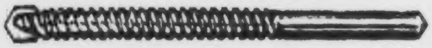
FIGURE 15



INFORMATION SHEET

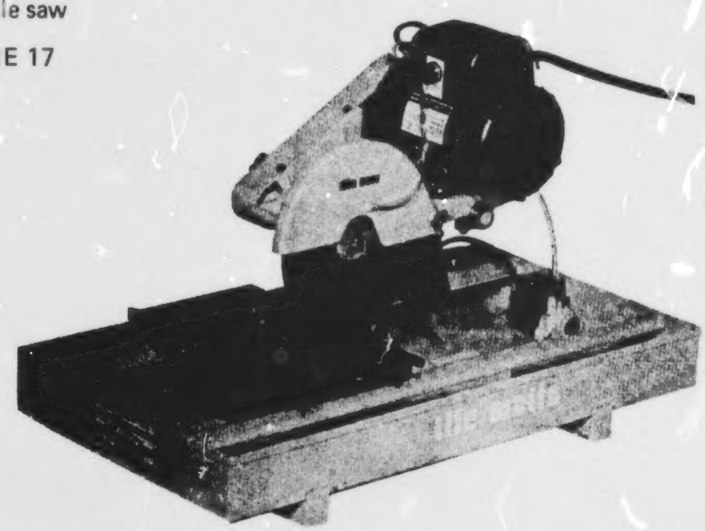
J. Carbide-tipped drill bit

FIGURE 16



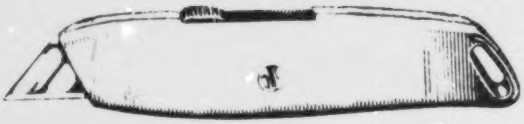
K. Tile saw

FIGURE 17



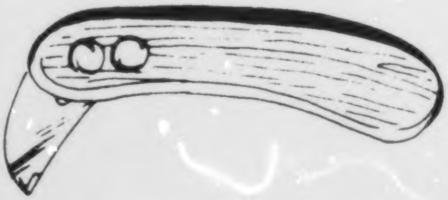
L. Razor blade knife

FIGURE 18



M. Carbide-tipped scoring tool

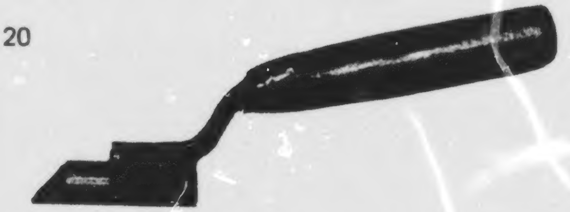
FIGURE 19



INFORMATION SHEET

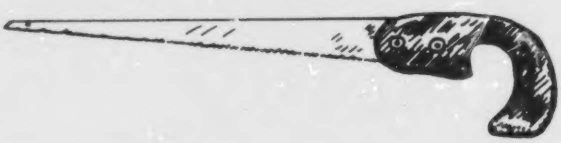
N. Grout saw

FIGURE 20



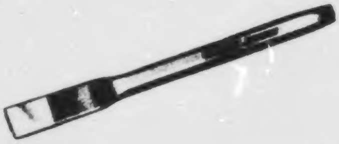
O. Keyhole saw

FIGURE 21



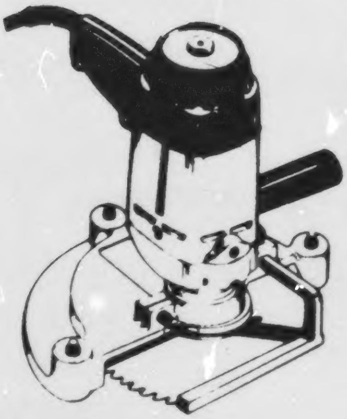
P. Carbide-tipped chisel

FIGURE 22



Q. Jamb saw

FIGURE 23



INFORMATION SHEET

VI. Uses of selected cutting and drilling tools used by tile setter

A. Tile cutter--Used to make straight cuts on tile and trim

B. Carbide wheel assembly--Used as replacement wheel for tile cutter

C. Chipping hammer--Used to chip excess material from the backs and edges of wall and quarry tile; reduces the amount of grinding work necessary to smooth a cut

D. Hole saw--Used to cut larger holes (usually more than 1" in diameter)

E. Hacksaw--Used to cut towel bars to desired lengths and to remove any metal that interferes with proper installation of tile

F. Nippers--Used to cut small pieces of tile that cannot be cut on a tile cutter; also used for cutting holes around pipes and light switches

(NOTE: The best nippers are carbide-tipped and spring-loaded.)

G. Tin snips--Used to cut metal lath and reinforcing wire

H. Rub stone (rub brick)--Used for smoothing rough edges of cut tile

(NOTE: A rub stone is usually made of silicon carbide.)

I. Electric drill and bit--Used to drill holes

J. Carbide-tipped drill bit--Used to drill holes in tiled surface; used only with electric drill and at low speeds

K. Tile saw--Used to make cuts when tile cutter cannot be used

(NOTE: A tile saw is an electric tool similar to a wood table saw except that it uses a special diamond blade which is cooled by water.)

L. Razor blade knife--Used for cutting gypsum board, cleaning joints, cutting felt paper and waterproof membrane, and for opening tile boxes and tile setting materials

M. Carbide-tipped scoring tool--Used to score glass mesh mortar units

N. Grout saw--Used to remove old grout when renovating

O. Keyhole saw--Used to cut holes in gypsum board

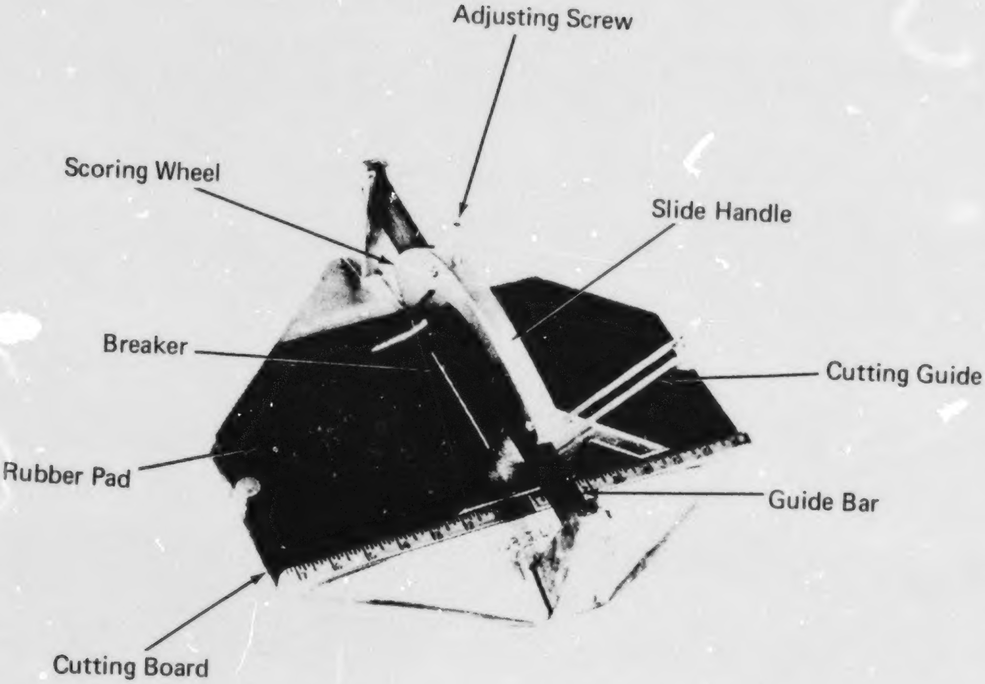
P. Carbide-tipped chisel--Used for chipping out broken or chipped tile in renovation and repair; used to make holes in glass mesh mortar units for installation of recessed fixtures

Q. Jamb saw--Used to cut door jambs and trim to allow room for tile or threshold

INFORMATION SHEET

VII. Parts of a tile cutter (Figure 24)

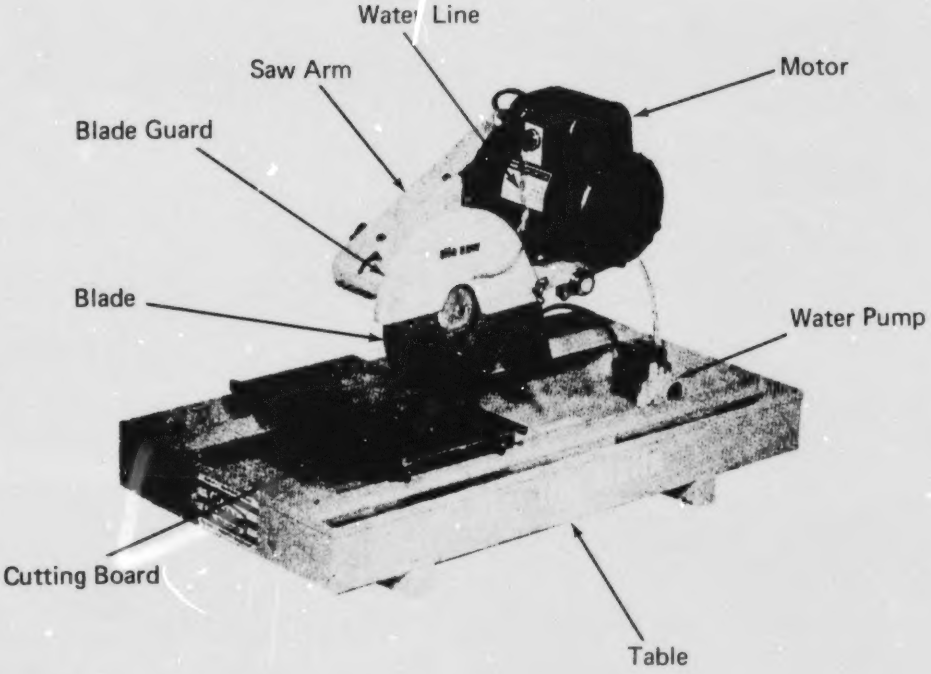
FIGURE 24


Adjusting Screw
Scoring Wheel
Slide Handle
Breaker
Cutting Guide
Rubber Pad
Guide Bar
Cutting Board

INFORMATION SHEET

VIII. Parts of a tile saw (Figure 25)

FIGURE 25

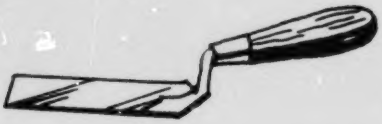

Water Line
Saw Arm
Motor
Blade Guard
Blade
Water Pump
Cutting Board
Table

INFORMATION SHEET

IX. Selected trowels used by tile setter (Figures 26-30; Assignment Sheets #1 and #2)

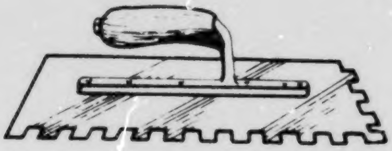
A. Margin trowel

FIGURE 26



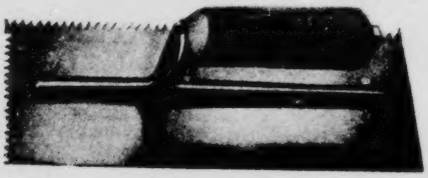
B. Square-notched trowel

FIGURE 27



C. V-notched trowel

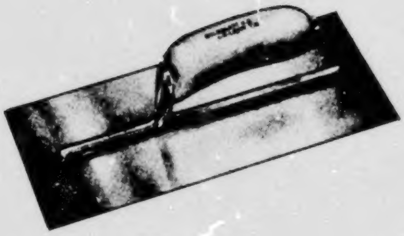
FIGURE 28



INFORMATION SHEET

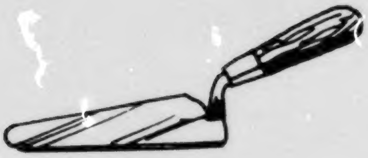
D. Cement trowel

FIGURE 29



E. Gauging trowel

FIGURE 30



X. Uses of selected trowels used by tile setter

A. Margin trowel--Used to mix grout and setting materials in very small quantities; also used for buttering tiles and aligning tile joints

B. Square-notched trowel--Used to spread setting material other than organic adhesive

C. V-notched trowel--Used to spread organic adhesive

D. Cement trowel--Used for smoothing and embedding fiberglass tape; used for spreading screed mortar, installing shower floors, and building mortar curbs

E. Gauging trowel--Used to mix grout and setting materials in normal work quantities; also used for buttering tiles with mortar and spreading screed mortar

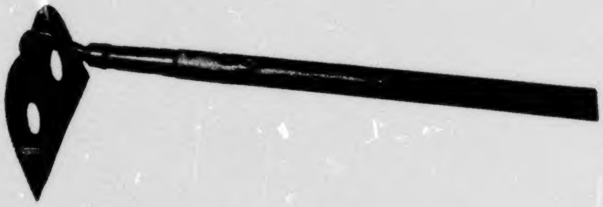
INFORMATION SHEET

XI. Uses of selected mortar tools used by tile setter (Figures 31-33; Assignment Sheets #1 and #2)

A. Mortar hoe--Used for hand-mixing mortar in a mortar box

EXAMPLE:

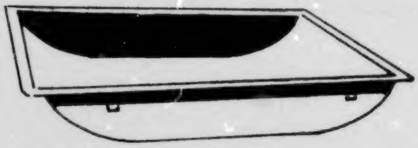
FIGURE 31



B. Mortar box--Used for mixing sand and cement for mortar

EXAMPLE:

FIGURE 32



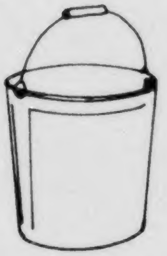
INFORMATION SHEET

C. Pail (bucket)--Used for mixing grouts and setting materials, transporting mortars, and holding water for grouting and cleaning

(NOTE: The tile setter should have a good assortment of pails and buckets, including at least one four-quart pail, one eight-quart pail, and several five-gallon pails.)

EXAMPLE:

FIGURE 33

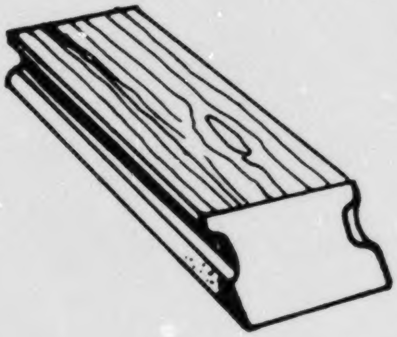


XII. Uses of special tools and basic equipment used by tile setter (Figures 34-52; Assignment Sheets #1 and #2)

A. Beating block--Used to beat in tiles so that they will be set in permanently and will be flush with each other in a flat plane

EXAMPLE:

FIGURE 34

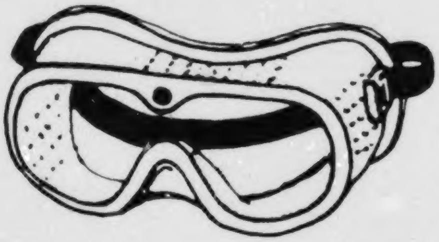


INFORMATION SHEET

B. Safety glasses or goggles--Used for eye protection when chipping or sanding surfaces

EXAMPLE:

FIGURE 35

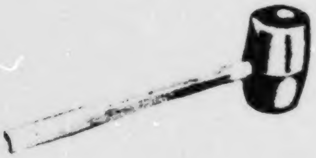


C. Rubber mallet--Used to beat in large tiles to obtain good contact with bond coat and set tiles flush in a flat plane; also used with beating block

(NOTE: The rubber mallet prevents damage to tiles and beating blocks that a regular hammer can easily cause.)

EXAMPLE:

FIGURE 36



INFORMATION SHEET

D. Toolbox or tool bag--Used to carry and store hand tools

EXAMPLES:

FIGURE 37

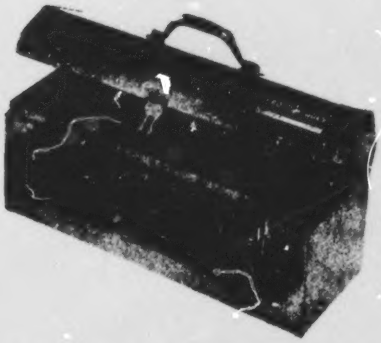
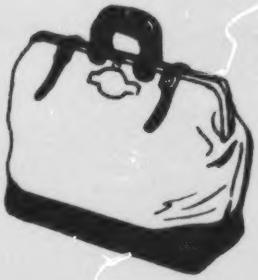


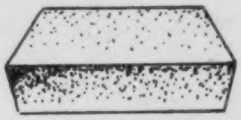
FIGURE 38



E. Sponge--Used for cleaning setting material or grout from tile surfaces and for smoothing grout joints

EXAMPLE:

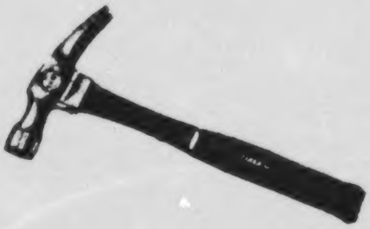
FIGURE 39



F. Claw hammer--Used for nailing backing board, for setting nail heads, and for breaking out holes in glass mesh mortar units

EXAMPLE:

FIGURE 40

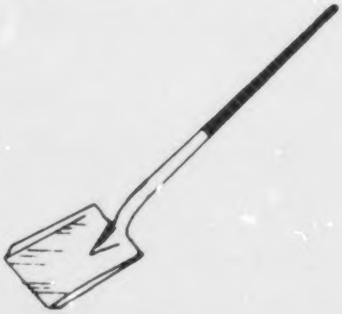


INFORMATION SHEET

G. Square-edged shovel--Used to measure and move cement and sand for mortar

EXAMPLE:

FIGURE 41

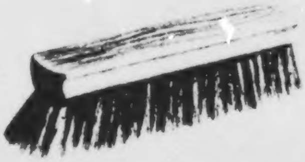


H. Scrub brush--Used to clean excess material from joints and surfaces of tile

(NOTE: The best size is 2 1/2" x 8" with semi-stiff nylon bristles.)

EXAMPLE:

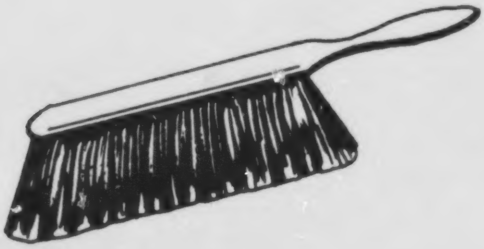
FIGURE 42



J. Duster brush--Used for clearing dust and debris from surfaces to be tiled

EXAMPLE:

FIGURE 43



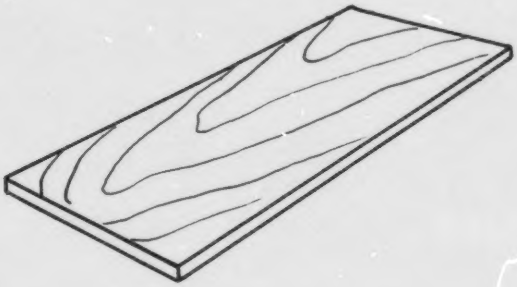
INFORMATION SHEET

K. Kneeling board--Used to walk on or kneel on while setting floor tile

(NOTE: The kneeling board is a piece of 5/8"-3/4" exterior grade plywood about 18" x 36". Be sure kneeling boards are not warped and are clean.)

EXAMPLE:

FIGURE 44



L. Rubber grouting trowel--Used to force grout into tile joints and to clean excess grout from face of tile

(NOTE: Rubber grouting trowels come in two styles, one for floors and one for walls.)

EXAMPLES:

FIGURE 45

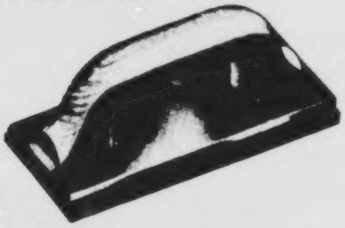
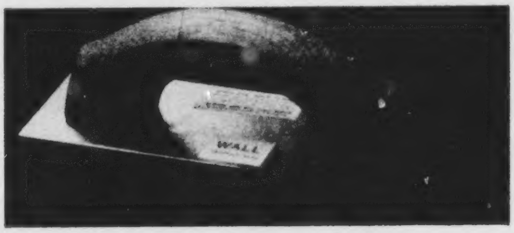


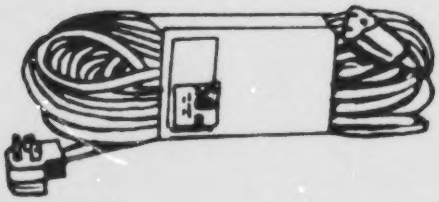
FIGURE 46



M. Extension cord--Used for power tools and to hook up lights in dark areas

EXAMPLE:

FIGURE 47



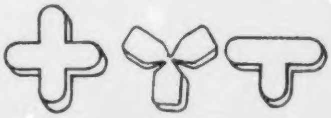
INFORMATION SHEET

N. Tile spacers--Used to control or create uniform joint widths

(NOTE: Tile spacers come in a variety of shapes and joint width sizes.)

EXAMPLES:

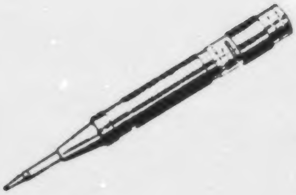
FIGURE 48



O. Center punch--Used to chip tile glaze so that drill may be started without slipping

EXAMPLE:

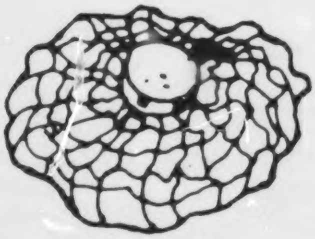
FIGURE 49



P. Nylon scouring pad--Used for removing setting material or grout from tile surfaces and joints; also used for cleaning tools

EXAMPLE:

FIGURE 50



INFORMATION SHEET

Q. Cheesecloth pad or terry cloth towel--Used for removing haze and polishing tile surfaces

EXAMPLE:

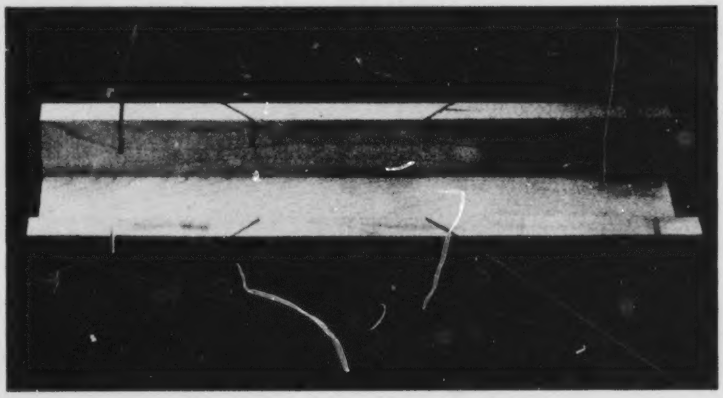
FIGURE 51

5 Sq. Yds.
LINT FREE
NEW
CHEESE
CLOTH

R. Mitre box--Used for cutting metal jambs, tracks, and headers for shower doors and tub enclosures

EXAMPLE:

FIGURE 52



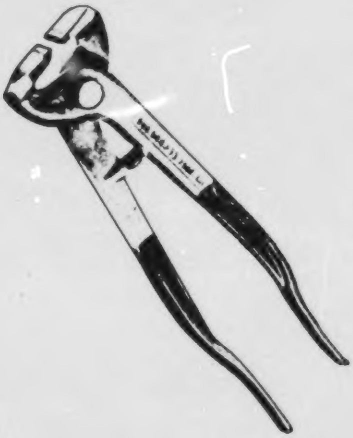
TOOLS
UNIT III

ASSIGNMENT SHEET #1--LABEL SELECTED TOOLS USED BY TILE SETTER

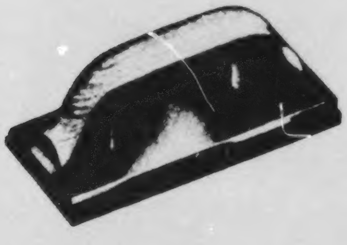
NAME______________________ SCORE______________

A good tile setter must learn to call tools by their correct names. The purpose of the following activity is to label the tools shown on this and the following pages by writing the correct names in the blanks.

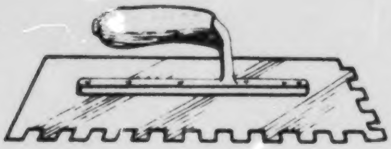
A. ______________________



B. ______________________

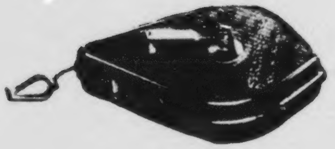


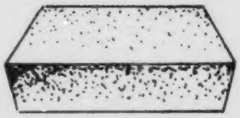
C. ______________________



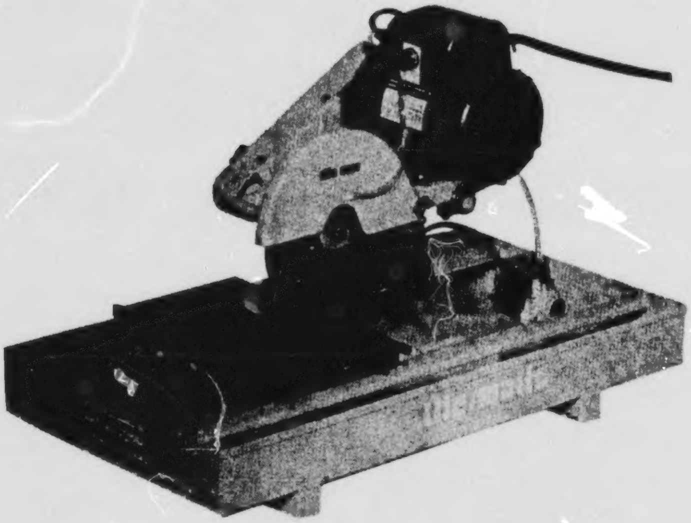
D. ______________________

ASSIGNMENT SHEET #1

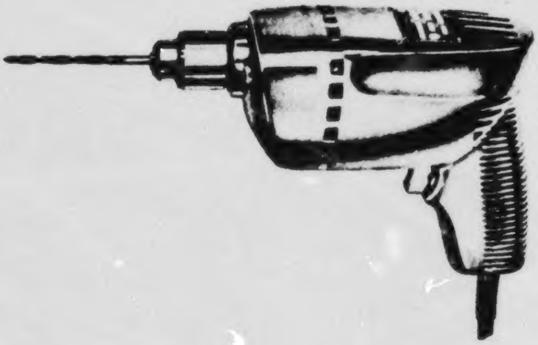




E. ______________________ F. ______________________

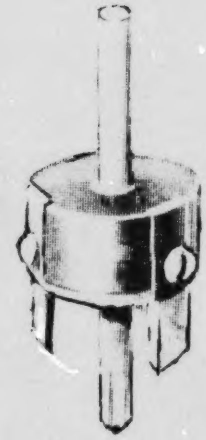


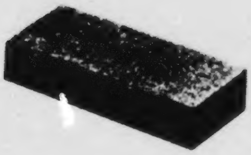
G. ______________________



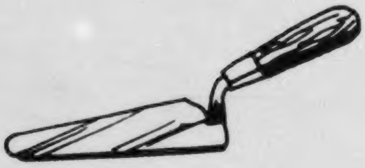
H. ______________________

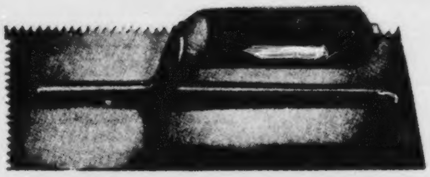
ASSIGNMENT SHEET #1



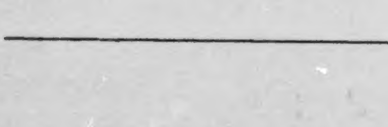


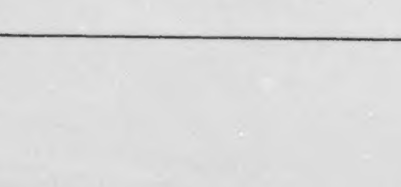
I. ______________________ J. ______________________





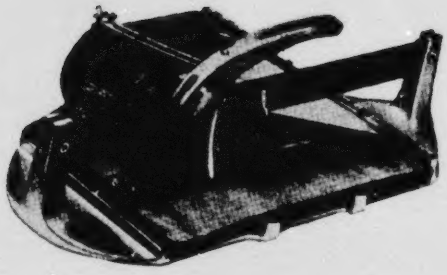
K. ______________________ L. ______________________

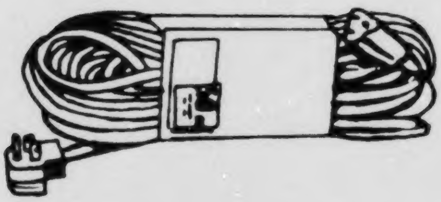




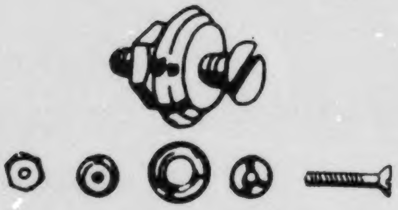
M. ______________________ N. ______________________

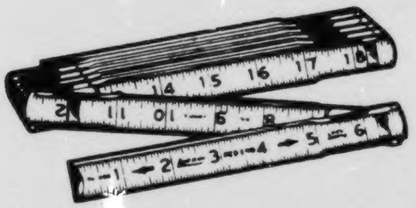
ASSIGNMENT SHEET #1



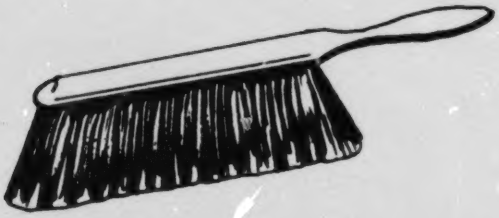


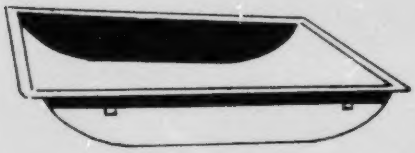
O. ______________________________ P. ______________________________





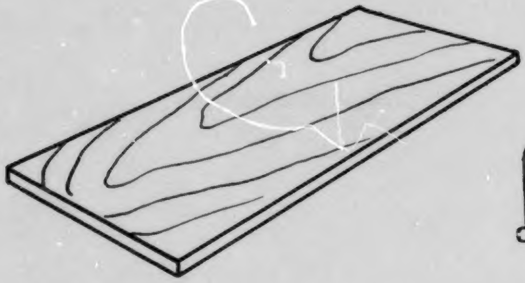
Q. ______________________________ R. ______________________________

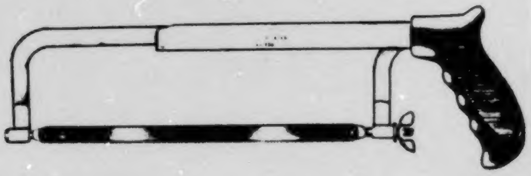




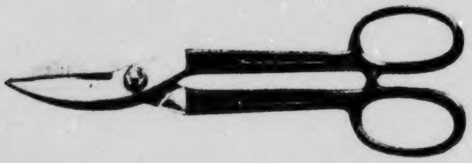
S. ______________________________ T. ______________________________

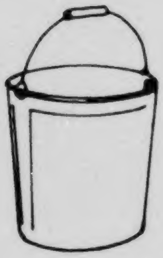
ASSIGNMENT SHEET #1



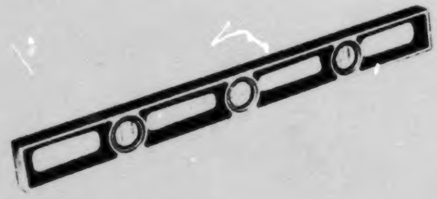


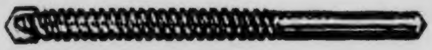
U. ______________________ V. ______________________





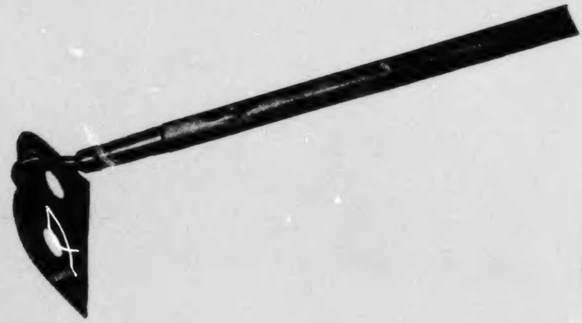
W. ______________________ X. ______________________

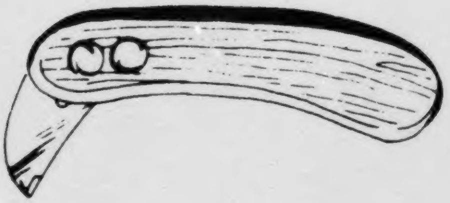




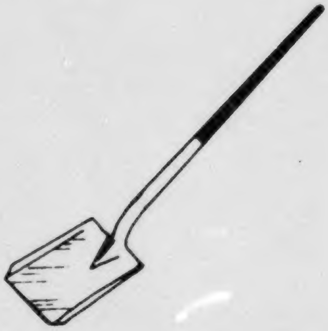
Y. ______________________ Z. ______________________

ASSIGNMENT SHEET #1

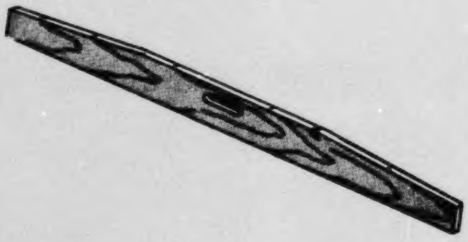


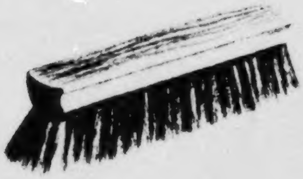


AA. ______________________________ BB. ______________________________



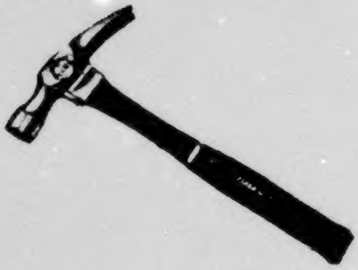
CC. ______________________________ DD. ______________________________

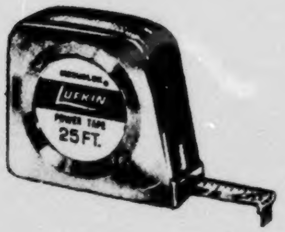




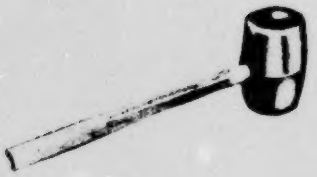
EE. ______________________________ FF. ______________________________

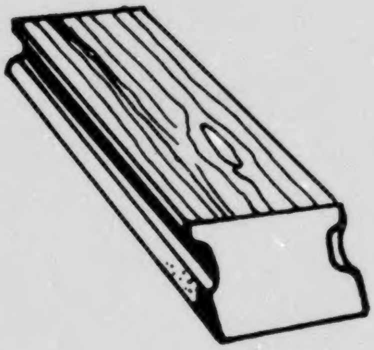
ASSIGNMENT SHEET #1



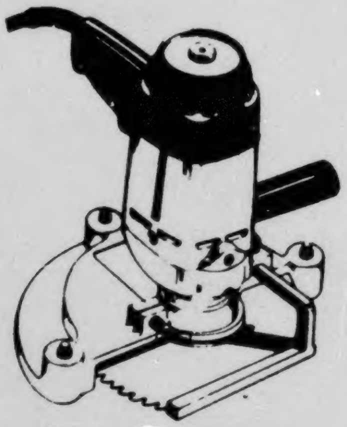

LUFKIN
POWER TAPE
25 FT.

GG. ______________________________ HH. ______________________________





II. ______________________________ JJ. ______________________________



KK. ______________________________

CT - 227-A

TOOLS
UNIT III

ASSIGNMENT SHEET #2--MAKE A LIST OF TOOLS AND EQUIPMENT NEEDED TO BEGIN TILE SETTING TRADE

NAME________________________________ SCORE____________________

It has been said that a good tile setter can be recognized by the tools selected, carried, and used--a statement that still holds true despite the mechanization of industry today. Care of the tools often reflects the quality of work a tile setter is capable of doing. Because only the best work is constantly expected of a tile setter, good judgment should be exercised in purchasing tools which, with some exceptions, will last for years. Only tools of the highest quality should be accepted and a sufficient number of tools to do the tile work should be kept on hand. Good, clean, well-maintained tools are a must for proper installations.

Talk to your instructor and/or experienced tile setters to make a list of the minimum tools needed to begin work as a tile setter.

Compare your list to that of classmates.

A. Which tools did lists of classmates have that you did not have on your list?

B. Which tools, if any, are you going to add to your list?

C. Which tools, if any, are you going to delete from your list?

TOOLS
UNIT III

ASSIGNMENT SHEET #3--CALCULATE COST OF TOOLS NEEDED BY BEGINNING TILE SETTER

NAME________________________ SCORE________________

What is the initial investment in a tile setter's tools? Using the list made in Assignment Sheet #2 and available tool catalogs, calculate cost of a "first set" of tools. Answer the questions that follow.

NAME OF TOOL	COST

A. What was the total cost of the tools needed by beginning tile setters?

____

B. Which tool(s) were most expensive?________________________

____

Were you surprised?______________Why or why not?______________

____

C. How will the cost of the tools affect how you care for them?

____

____

TOOLS
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A. Steel square
B. Nippers
C. Rubber grouting trowel
D. Square-notched trowel
E. Chalk line
F. Sponge
G. Tile saw
H. Electric drill and bit
I. Hole saw
J. Rub stone
K. Gauging trowel
L. V-notched trowel
M. Margin trowel
N. Cement trowel
O. Tile cutter
P. Extension cord
Q. Carbide wheel assembly
R. Wood folding rule
S. Duster brush
T. Mortar box
U. Kneeling board
V. Hacksaw
W. Tin snips
X. Pail (bucket)
Y. Level
Z. Carbide-tipped drill bit
AA. Mortar hoe
BB. Carbide-tipped scoring tool
CC. Chipping hammer
DD. Square-edged shovel
EE. Straightedge
FF. Scrub brush
GG. Claw hammer
HH. Measuring tape
II. Rubber mallet
JJ. Beating block
KK. Jamb saw

Assignment Sheet #2--Evaluated to the satisfaction of the instructor

(NOTE: The basic tool kit to be required by the beginning tile setter for residential thin-set methods will vary with location, specialization, employer, and other factors.)

Assignment Sheet #3--Evaluated to the satisfaction of the instructor

TOOLS
UNIT III

JOB SHEET #1--USE NIPPERS

I. Tools

A. Nippers

(NOTE: Some nippers are better than others because they have a carbide-tipped biting edge and are spring-loaded. Start with a good pair, as they will be used often and they will last a long time if the biting edge is made of carbide steel.)

B. Tile pieces

C. Rub stone (rub brick)

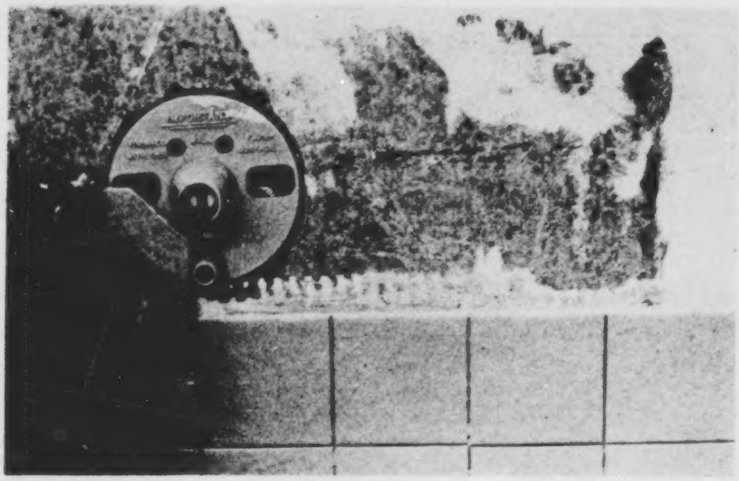
D. Marking pen

II. Procedure

(NOTE: Use nippers for tile cuts that cannot be made using the tile cutter.)

A. Use marking pen to mark the tile piece where it is to be cut (Figure 53)

FIGURE 53



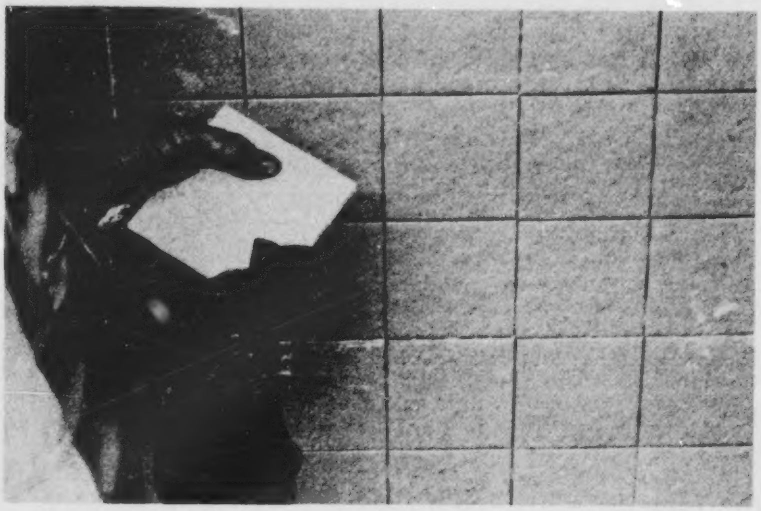
JOB SHEET #1

B. Use nippers to cut small depths or bites toward the marked place (Figure 54)

(CAUTION: Nippers should be moved down and away from the tile.)

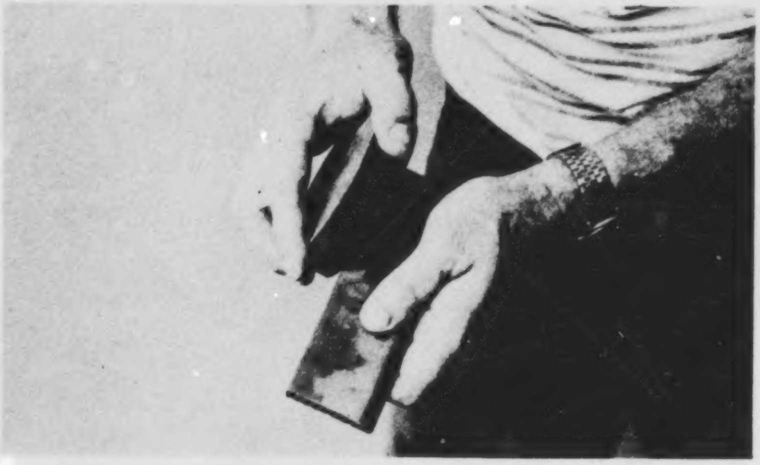
(NOTE: If you are cutting a curve or slant, take smaller bites. Experience is the best teacher in learning to use nippers.)

FIGURE 54



C. Use the rubbing stone to smooth the cut edge after you have finished using the nippers (Figure 55)

FIGURE 55



D. Clean and oil nippers before returning to toolbox or tool bag

TOOLS
UNIT III

JOB SHEET #2--USE TILE CUTTER

I. Tools and materials

   A. Tile cutters

      (NOTE: Not only are tile cutters available in small, medium, and large sizes, but they are also available in special sizes to cut different sizes of tile. A medium-sized tile cutter is most often used by tile setters.)

   B. Tile pieces

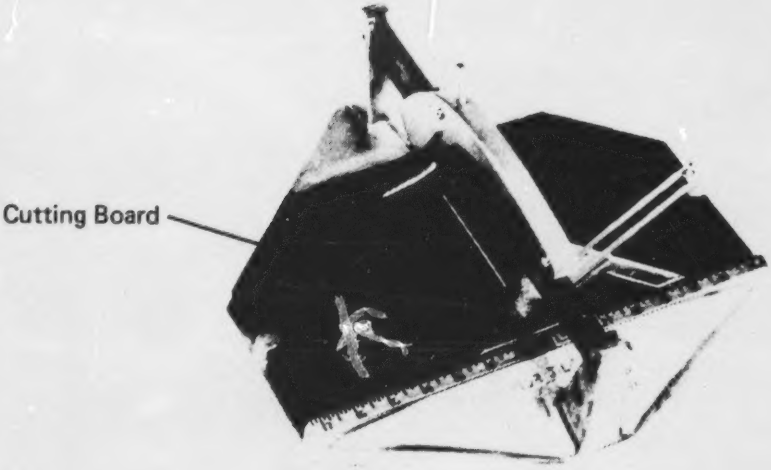
   C. Light machine oil

II. Procedure

   A. Examine tile cutter

      1. Notice the stationary cutting board (Figure 56)

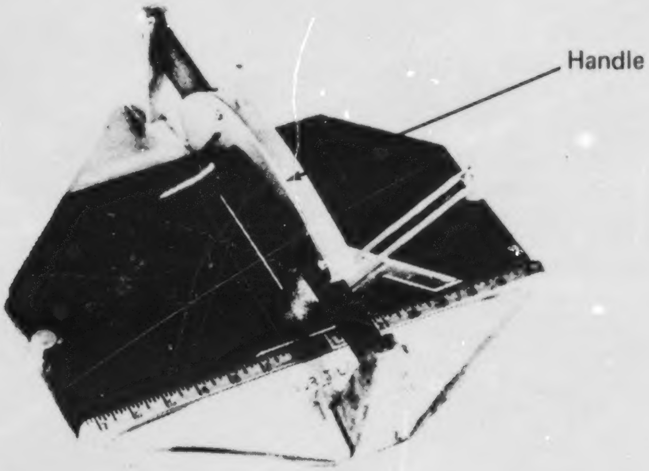
FIGURE 56



JOB SHEET #2

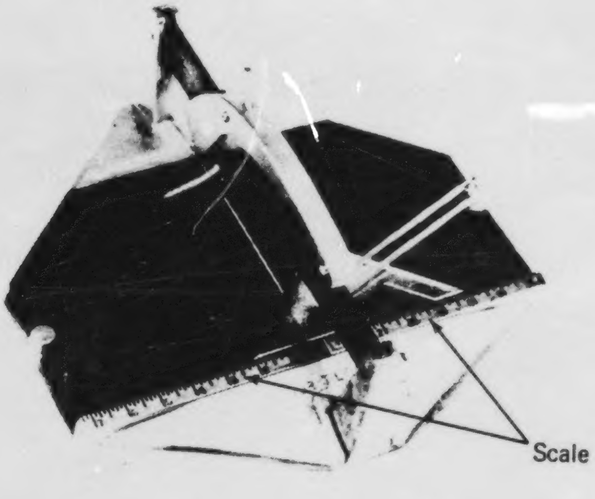
2. Notice the handle and wheel that move back and forth along the guide (Figure 57)

FIGURE 57



3. Notice that the cutting board is marked off on both sides of the cutter's path; use either side for measuring the size of the cut (Figure 58)

FIGURE 58



JOB SHEET #2

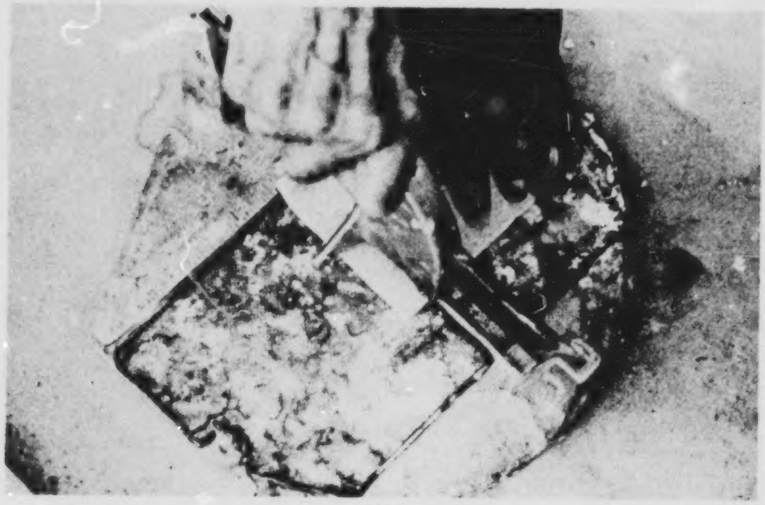
B. Lay a piece of tile on the rubber pads of the cutting board and position it where you want the cut

C. Hold tile firmly with one hand; set guide if more than one cut of same size is to be made

D. Use handle to apply pressure to wheel when it makes contact with surface of tile

E. Run the cutting wheel firmly over the tile to score tile once by moving wheel toward you (Figure 59)

FIGURE 59



F. Move handle back to position breaker arms at edge of tile

G. Adjust height of breaker arms with setscrew on top of handle if required

(NOTE: After you have cut a few peices, you will get the feel of how the tile cutter works.)

H. Press straight down on handle to break tile on scored mark that wheel has made

(NOTE: This completes the cut. After you have cut a few pieces, you will get the feel of how the tile cutter works.)

I. Clean tile cutter before storing, taking care to clean the rubber pads

J. Oil bar on which the handle slides and cutting wheel as needed

TOOLS
UNIT III

JOB SHEET #3--USE TILE SAW

I. Tools and materials

- A. Tile saws
- B. Extension cords
- C. Pieces of tile
- D. Source of water

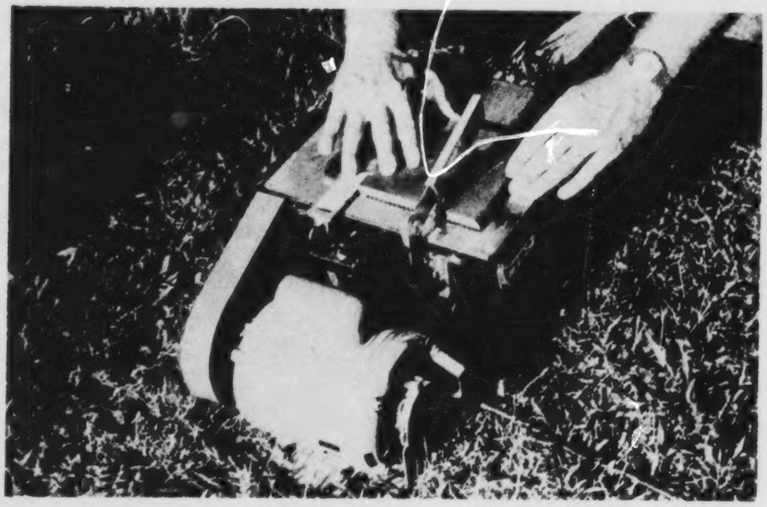
II. Procedure

- A. Examine the tile saw carefully; read instruction book if available
- B. Fill water container

  (NOTE: Always keep plenty of water in the container. Sufficient water must spray on diamond blade at all times during cutting.)

- C. Set the guide and cut several tiles (Figure 60)

FIGURE 60



- D. Empty water container after use

TOOLS
UNIT III

JOB SHEET #4--USE ELECTRIC DRILL

I. Tools and materials

A. Electric drill, variable speed (at least 1/4 horsepower)

B. Extension cord

C. Carbide masonry drill bits (usually 1/4")

(NOTE: Carry several sizes.)

D. Steel punch

E. Assorted plastic plugs and screws

F. Various backings, including tiled surface

II. Procedure

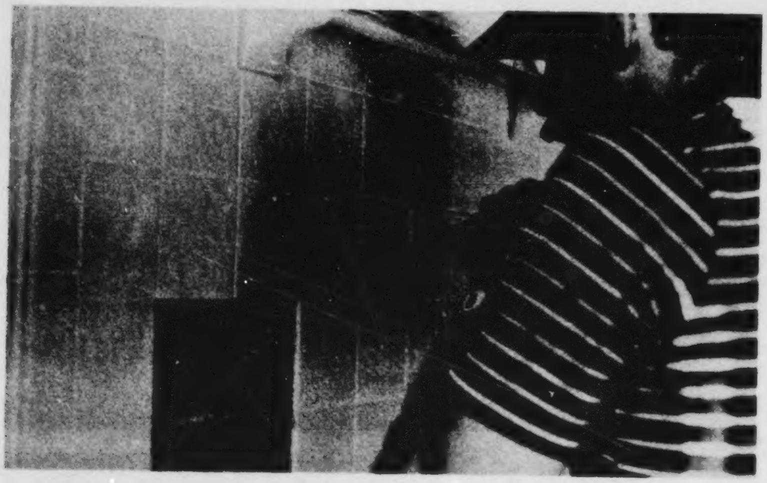
A. Select the right size carbide bit for the plug to be used

B. Insert the bit and tighten securely into drill

C. Use sharp steel punch to lightly tap center of hole (Figure 61)

(NOTE: This keeps the bit from moving around and scratching the tile on surface to be drilled. The size of the bit depends on the size of the plug.)

FIGURE 61



JOB SHEET #4

D. Run the drill at slow speeds

E. Drill hole deep enough to insert the plug completely and accept the length of the screw

TOOLS
UNIT III

JOB SHEET #5--USE A LEVEL

I. Equipment and materials

  A. Levels, various lengths

  B. Vertical and horizontal work surfaces

  C. Pencil

  D. Tape

  E. Straightedge

II. Procedures for leveling

  A. Check level for accuracy

  (NOTE: Levels are very delicate instruments which must be handled carefully to ensure accuracy. Levels should be checked for accuracy before use, especially if the instrument has been dropped or jarred.)

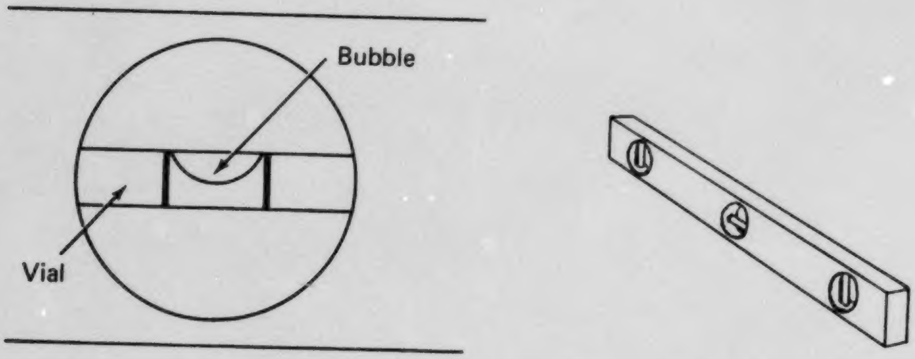
    1. Set base of level on flat, horizontal surface

    2. Check bubble position in horizontal vial

    3. Adjust surface or location of level until bubble is centered

    (NOTE: On a level surface, the bubble will lie evenly positioned between the lines on the vial. See Figure 62)

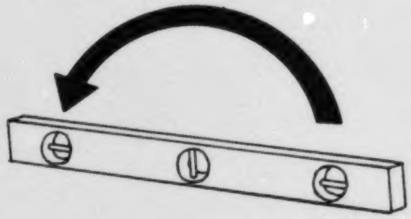
FIGURE 62



JOB SHEET #5

4. Rotate the level end-for-end and position it in the exact same location as that of bubble-centered reading (Figure 63)

FIGURE 63



5. Check bubble position in the horizontal vial

   (NOTE: The bubble will be centered from this side also if the level is accurate.)

6. Replace or repair level as necessary

B. Level a surface

1. Visually check surface for irregularities and foreign matter such as dirt

   (NOTE: Even small surface irregularities or particles can cause inaccurate readings in the level.)

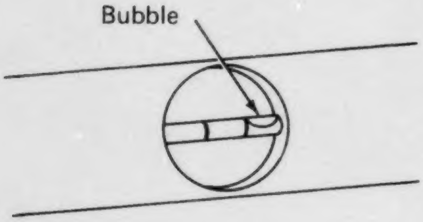
2. Clean or replace surface as necessary

3. Set base of level carefully and squarely on surface

4. Check bubble position

   (NOTE: The bubble will be displaced toward the high end of the level. See Figure 64)

FIGURE 64



JOB SHEET #5

5. Adjust surface as necessary

6. Take additional readings to level surface as required

   (NOTE: Many factors affect the number of readings required. These include type of surface, material being used, type of application, size of area to be tiled, length of level, and others.)

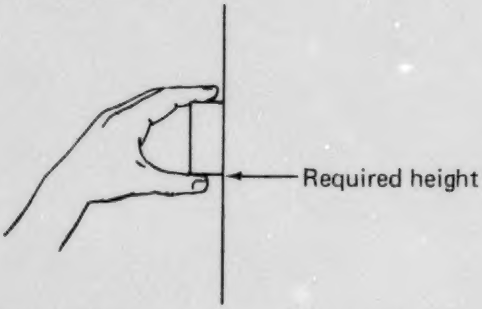
C. Draw horizontal line on vertical surface

1. Visually inspect surface for irregularities and foreign matter

2. Clean or replace surface as necessary

3. Place side of level carefully and squarely against surface at required height of line (Figure 65)

FIGURE 65

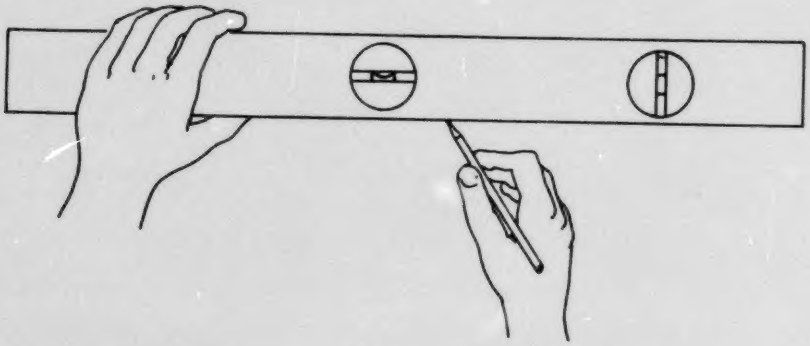


4. Adjust level position to center bubble with instrument at correct height

5. Use pencil to mark line along edge of level (Figure 66)

   (NOTE: Because the level is used for drawing straight lines, the surfaces and edges must be protected from nicks and other damage. Many good levels have metal edges for this reason.)

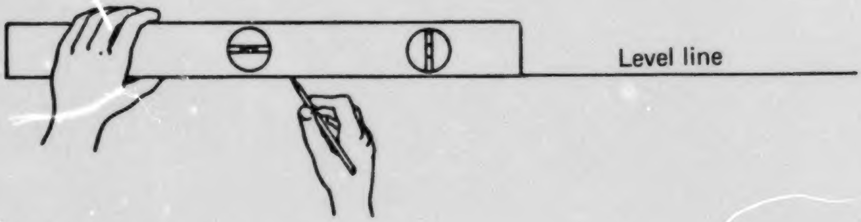
FIGURE 66



JOB SHEET #5

6. Reposition the level or use level in combination with a straigtedge (Figure 67) to draw line to required length

FIGURE 67

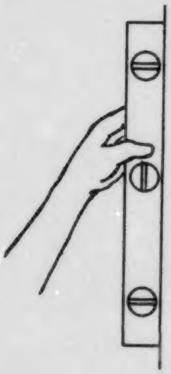


III. Procedures for plumbing

A. Check for accuracy in plumbing

1. Place base of level against flat, vertical surface (Figure 68)

FIGURE 68



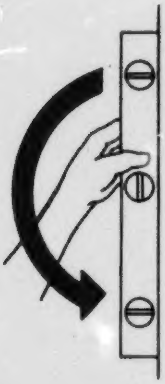
2. Check bubble position in upper horizontal vial

3. Adjust surface or location of level until bubble is centered and mark position on wall

JOB SHEET #5

4. Rotate level end-for-end and position it in the exact same location as that of the bubble-centered reading (Figure 69)

FIGURE 69



5. Check bubble position in the upper horizontal vial

   (NOTE: The bubble will be centered at this end also if level is accurate.)

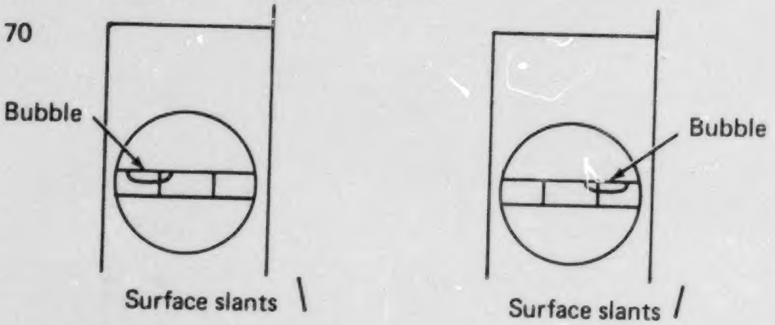
6. Replace or repair level as necessary

B. Plumb a surface

1. Visually check surface for irregularities and foreign matter such as dirt
2. Clean or replace surface as necessary
3. Place base of level carefully and squarely against surface
4. Check bubble position in upper vial

   (NOTE: The bubble will move toward one end of the vial if the surface is not plumb. To plumb the surface, you must adjust it in the direction of bubble displacement. See Figure 70.)

FIGURE 70



JOB SHEET #5

5. Adjust surface as necessary

6. Take additional readings to plumb as required

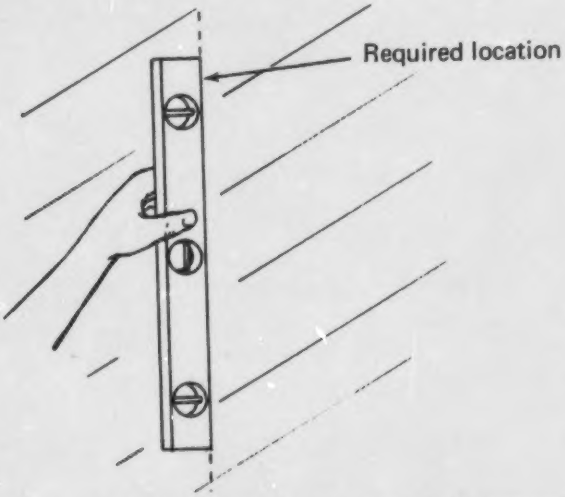
C. Draw vertical line on vertical surface

1. Visually check surface for irregularities and foreign matter

2. Clean or replace surface as necessary

3. Place side of level against surface at required location of line (Figure 71)

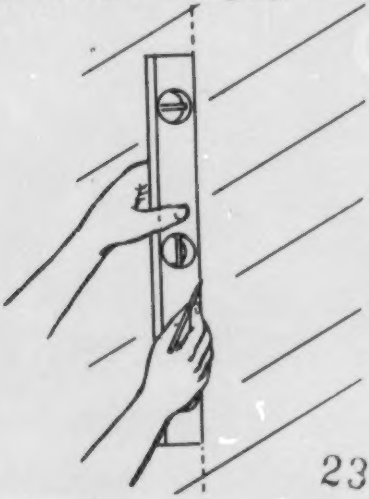
FIGURE 71



4. Adjust level position to center bubble with instrument at correct location

5. Use pencil to mark line along edge of level (Figure 72)

FIGURE 72



JOB SHEET #5

6. Reposition level or use level in combination with a straightedge to draw line to required length

TOOLS
UNIT III

TEST

NAME______________________________ SCORE____________________

1. Match to their correct definitions terms associated with tools used by the tile setter. Write the correct numbers in the blanks.

_____a. Metal mesh which acts as a background or reinforcing agent for the scratch or mortar coat

_____b. Modified portland cement or noncement based material used for filling tile joints

_____c. To spread a bond coat on the back of a ceramic tile just before the tile is placed

_____d. Even or unbroken line or surface; being even or on the same line or plane

1. Lath
2. Flush
3. Butter
4. Grout

2. Select from the following list rules for proper and safe use and care of tools. Write an "X" in the blank before each correct answer.

_____a. Replace lost or damaged tools

_____b. Buy inexpensive tools so that you may have two of each tool

_____c. Purchase sufficient number of tools

_____d. Select high quality tools

_____e. Shake level thoroughly before using to set bubble

_____f. Use gasoline to clean tools

_____g. Lay tools down carefully in a safe place to prevent damage

_____h. Ensure that chisels have mushroomed heads to provide larger target

_____i. Always use precautions to protect finished surfaces from damage by tools

_____j. Lay tools in cabinet when working on counter tops to avoid dropping and damaging work surface

_____k. Check notched trowels and replace if worn

TEST

_____l. Avoid dropping tools

_____m. Learn which tools may be substituted for each other, such as screwdrivers for chisels or pry bars

_____n. Keep tools sharp

_____o. Clean all tools and equipment before storing them

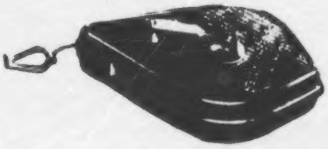
_____p. Sharpen drill bits after each use

_____q. Keep light bulbs enclosed in wire protectors while in use

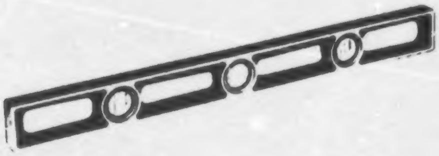
_____r. Avoid immersing wooden tool handles in water for extended periods of time

_____s. Use tools only for jobs for which they are intended

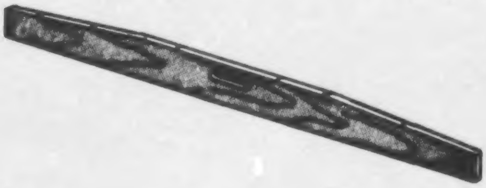
3. Name frequently used layout and leveling tools.



a. ____

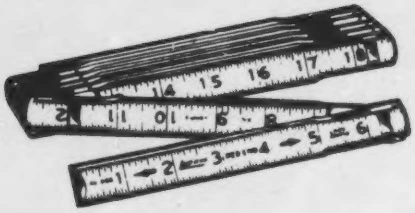


b. ____

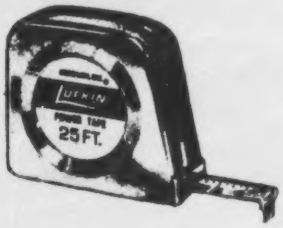


c. ____

TEST


14
15
16
17
1
2
3
4
5
6

d. ______________________________


LUFKIN
25 FT.

e. ______________________________

f. ______________________________

TEST

4. Match to their correct uses selected tools used by tile setter in layout and leveling. Write the correct numbers in the blanks.

______a. Used for laying down working, finish, and level lines

______b. Used to square tile layouts

______c. Used to spread mortar or level thick-bed mortar; placed on starting line and used as a straightedge against which to butt tile

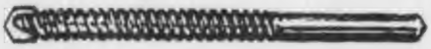
______d. Used to measure walls, and other relatively long surfaces

______e. Used to draw starting lines and to level curbs and door jambs

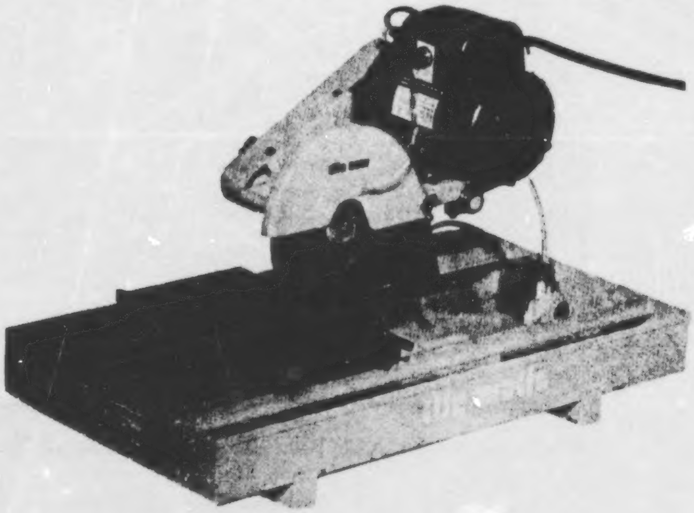
______f. Used to measure tile cuts and other relatively short distances

1. Steel measuring tape
2. Chalk line
3. Wood folding rule
4. Steel square
5. Straightedge
6. Level

5. Name basic cutting and drilling tools used by tile setter.

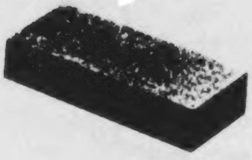


a. ______________________________

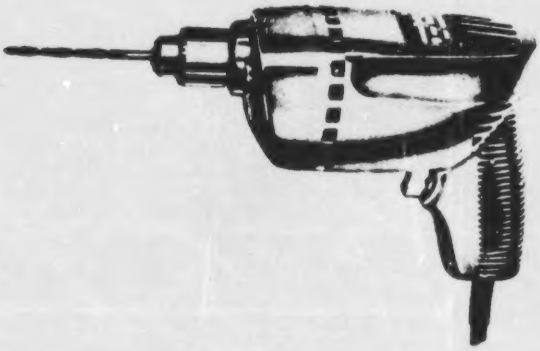


b. ______________________________

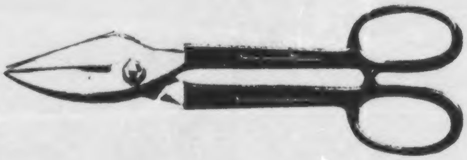
TEST



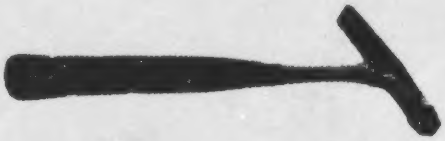
c. ____



d. ____

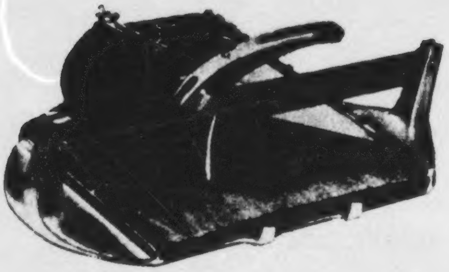


e. ____

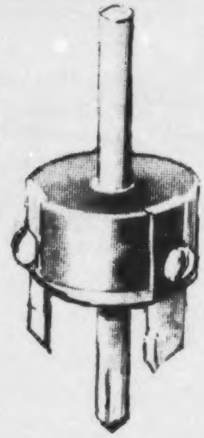


f. ____

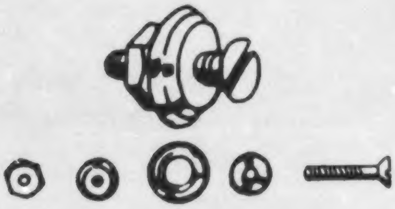
TEST



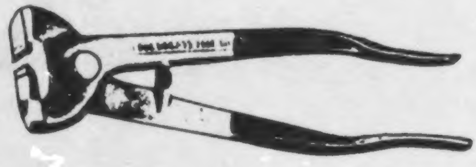
g. ____



h. ____

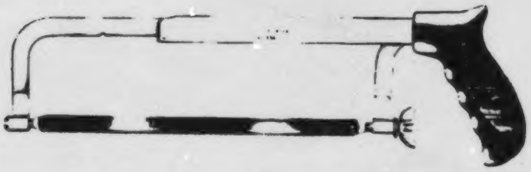


i. ____

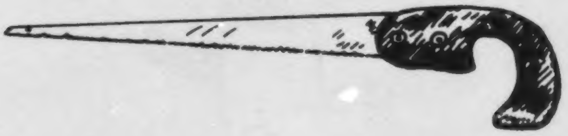


j. ____

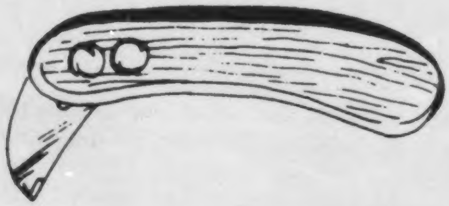
TEST



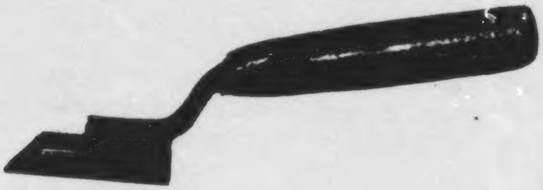
k. ____________________



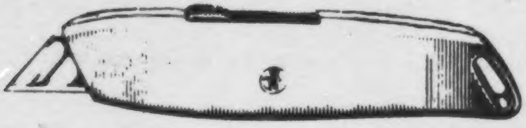
l. ____________________



m. ____________________

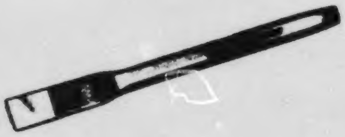


n. ____________________

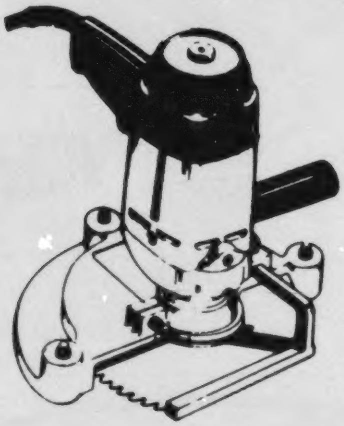


o. ____________________

TEST



p. ______________________________



q. ______________________________

6. Match to their correct uses selected cutting and drilling tools used by tile setter. Write the correct numbers in the blanks. Definitions continue on next page.

_____a. Used to cut larger holes (usually more than 1" in diameter)

_____b. Used as replacement wheel for tile cutter

_____c. Used to chip excess material from the backs and edges of wall and quarry tile; reduces the amount of grinding work necessary to smooth a cut

_____d. Used to make straight cuts on tiles and trim

_____e. Used to drill holes

_____f. Used to make cuts when tile cutter cannot be used

_____g. Used to cut metal lath and reinforcing wire

_____h. Used for smoothing rough edges of cut tile

1. Hacksaw
2. Tile saw
3. Nippers
4. Tile cutter
5. Electric drill
6. Chipping hammer
7. Tin snips
8. Carbide-tipped drill bit

TEST

______i. Used to cut towel bars to desired lengths and to remove any metal that interferes with proper installation of tile

______j. Used to drill holes in tiled surface

______k. Used to cut small pieces of tile that cannot be cut on a tile cutter; also used for cutting holes around pipes and light surface

______l. Used to cut holes in gypsum board

______m. Used for cutting gypsum board, cleaning joints, cutting felt paper and waterproof membrane, and for opening tile boxes and tile setting materials

______n. Used for chipping out broken or chipped tile in renovation and repair; used to make holes in glass mesh mortar units for installation of recessed fixtures

______o. Used to score glass mesh mortar units

______p. Used to remove old grout when renovating

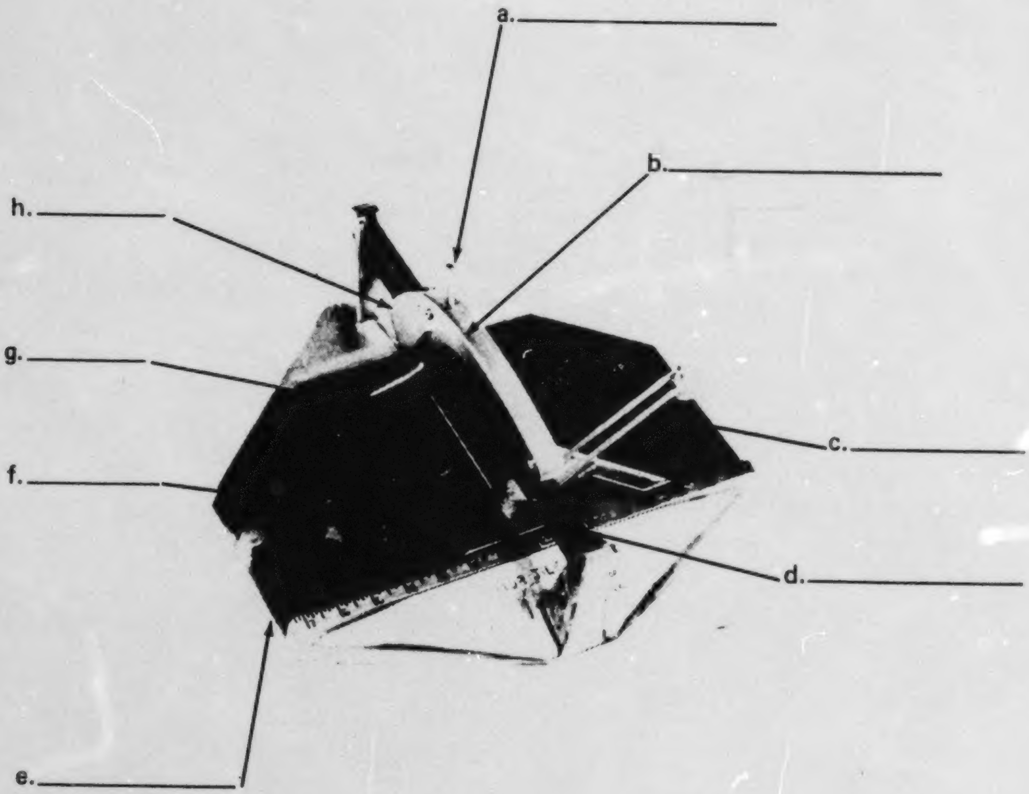
______q. Used to cut door jambs and trim to allow room for tile or threshold

9. Carbide wheel assembly
10. Rubbing stone
11. Hole saw
12. Carbide-tipped chisel
13. Jamb saw
14. Grout saw
15. Scoring tool
16. Razor blade knife
17. Keyhole saw

TEST

7. Identify parts of a tile cutter.

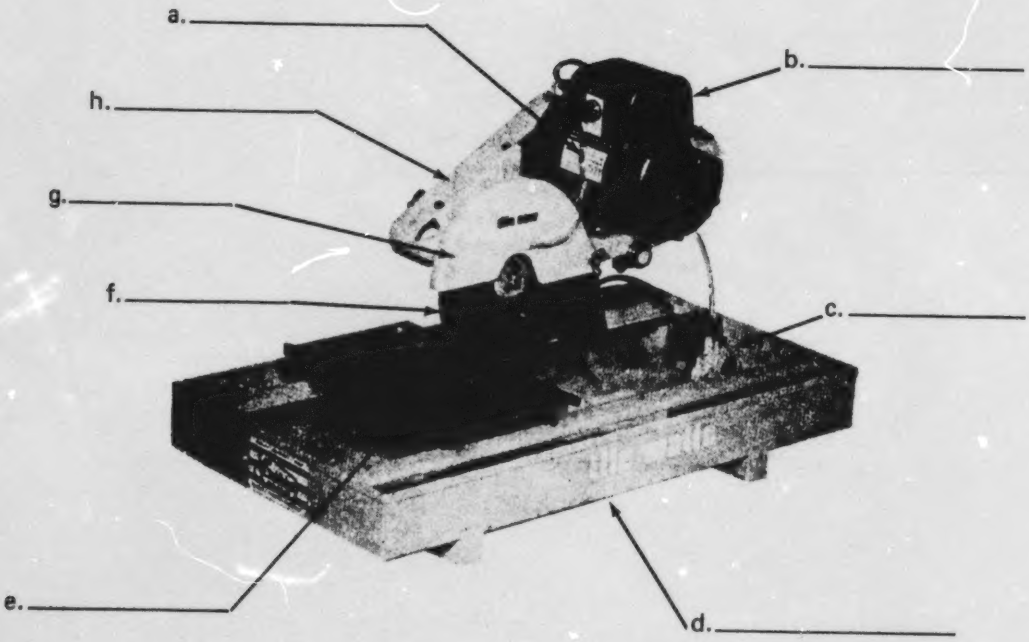
Guide bar
Rubber pad
Adjusting screw
Slide handle
Scoring wheel
Cutting guide
Cutting board
Breaker



TEST

8. Identify parts of a tile saw.

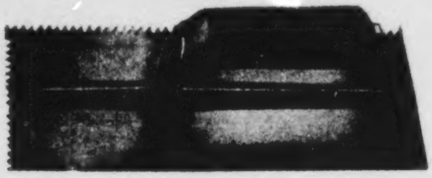
Motor
Cutting board
Saw arm
Blade
Water pump
Table
Blade guide
Water line



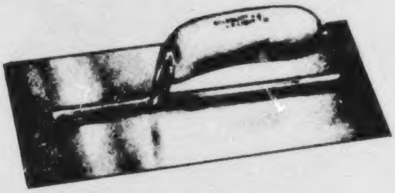
TEST

9. Identify selected trowels used by tile setter.

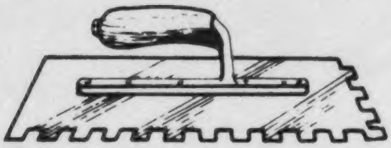
Margin trowel
Square notched trowel
V-notched trowel
Cement trowel
Gauging trowel



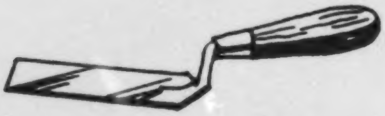
a. ______________________________



b. ______________________________

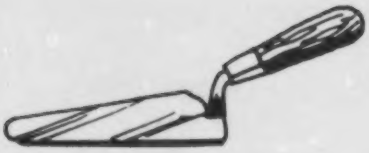


c. ______________________________



d. ______________________________

TEST



e. ____

10. Match to their correct uses selected trowels used by tile setter. Write the correct numbers in the blanks.

_____a. Used to spread setting material other than organic adhesive

_____b. Used to spread organic adhesive

_____c. Used to mix grout and setting materials in very small quantities; also used for and buttering tiles and aligning tile joints

_____d. Used to mix grout and setting materials in normal work quantities; also used for buttering tiles with mortar and spreading screed mortar

_____e. Used for smoothing and embedding fiberglass tape; used for spreading screed mortar, installing shower floors, and building curbs

1. Square-notched trowel
2. Margin trowel
3. V-notched trowel
4. Cement trowel
5. Gauging trowel

11. Match to their correct uses selected mortar tools used by tile setter. Write the correct numbers in the blanks.

_____a. Used for mixing sand and cement for mortar

_____b. Used for hand-mixing mortar in a mortar box

_____c. Used for mixing grouts and setting materials, transporting mortars, and holding water for grouting and cleaning

1. Mortar box
2. Pail (bucket)
3. Mortar hoe

TEST

12. Match to their correct uses special tools and basic equipment used by tile setter. Write the correct numbers in the blanks. Some blanks may have more than one correct answer. Uses continue on next page.

______ a. Used for nailing backing board, for setting nail heads, and for breaking out holes in glass mesh mortar units

______ b. Used for eye protection when chipping or sanding surfaces

______ c. Used for cleaning setting material or grout from tile surfaces and for smoothing grout joints

______ d. Used to carry and store hand tools

______ e. Used to beat in large tiles to obtain good contact with bond coat and set tiles flush in a flat plane; also used with beating block

______ f. Used to beat in tiles so that they will be set in permanently and will be flush with each other in a flat plane

______ g. Used for power tools and to hook up lights in dark areas

______ h. Used to walk on or kneel on while setting floor tile

______ i. Used to control or create uniform joint widths

______ j. Used to chip tile glaze so that drill may be started without slipping

______ k. Used for removing haze and polishing tile surfaces

______ l. Used for clearing dust and debris from surfaces to be tiled

______ m. Used to remove excess material from joints and surfaces of tile

______ n. Used to force grout into tile joints and to clean excessive grout from tiles

______ o. Used to measure and move cement and sand for mortar

1. Rubber mallet
2. Toolbox or tool bag
3. Claw hammer
4. Rubber grouting trowel
5. Beating block
6. Kneeling board
7. Safety glasses or goggles
8. Sponge
9. Square-edged shovel
10. Scrub brush
11. Duster brush
12. Center punch
13. Tile spacers
14. Mitre box
15. Cheesecloth pad or terry cloth towel

TEST

_____p. Used for removing setting material or grout from tile surfaces and joints; also used for cleaning tools

_____q. Used for cutting metal jambs, tracks, and headers for shower doors and tub enclosures

16. Extension cord

17. Nylon scouring pad

(NOTE: Test questions 13-16 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

13. Label selected tools used by tile setter.

14. Make a list of tools and equipment needed to begin tile setting trade.

15. Calculate cost of tools needed by beginning tile setter.

16. Demonstrate the ability to

    a. Use nippers.

    b. Use tile cutter.

    c. Use tile saw.

    d. Use electric drill.

    e. Use a level.

TOOLS
UNIT III

ANSWERS TO TEST

1. a. 1
   b. 4
   c. 3
   d. 2

2. a, c, d, g, i, k, l, n, o, q, r, s

3. a. Chalk line
   b. Level
   c. Straightedge
   d. Wood folding rule
   e. Steel measuring tape
   f. Steel square

4. a. 2
   b. 4
   c. 5
   d. 1
   e. 6
   f. 3

5. a. Carbide-tipped drill bit
   b. Tile saw
   c. Rub stone
   d. Electric drill and bit
   e. Tin snips
   f. Chipping hammer
   g. Tile cutter
   h. Hole saw
   i. Carbide wheel assembly
   j. Nippers
   k. Hacksaw
   l. Keyhole saw
   m. Carbide-tipped scoring tool
   n. Grout saw
   o. Razor blade knife
   p. Carbide-tipped chisel
   q. Jamb saw

6. a. 11
   b. 9
   c. 6
   d. 4
   g. 7
   h. 10
   i. 1
   j. 8
   m. 16
   n. 14 or 12
   o. 15
   p. 12 or 14

ANSWERS TO TEST

e. 5
f. 2
k. 3
l. 17
q. 13

7. a. Adjusting screw
   b. Slide handle
   c. Cutting guide
   d. Guide bar
   e. Cutting board
   f. Rubber pad
   g. Breaker
   h. Scoring wheel

8. a. Water line
   b. Motor
   c. Water pump
   d. Table
   e. Cutting board
   f. Blade
   g. Blade guard
   h. Saw arm

9. a. V-notched trowel
   b. Cement trowel
   c. Square-notched trowel
   d. Margin trowel
   e. Gauging trowel

10. a. 1
    b. 3
    c. 2
    d. 5
    e. 4

ANSWERS TO TEST

11. a. 1
    b. 3
    c. 2

12. a. 3
    b. 7
    c. 8
    d. 2
    e. 1
    f. 5
    g. 16
    h. 6
    i. 13
    j. 12
    k. 15
    l. 11
    m. 8, 10, or 17
    n. 4
    o. 9
    p. 8, 10, or 17
    q. 14

13. Evaluated to the satisfaction of the instructor

14. Evaluated to the satisfaction of the instructor

15. Evaluated to the satisfaction of the instructor

16. Performance skills evaluated to the satisfaction of the instructor

MEASURING
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to use basic measuring tools. The student should also be able to read a rule in feet, inches, and fractions of inches down to one-sixteenth of an inch. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match measuring terms to their correct definitions.
2. Identify basic measuring tools used by the tile setter.
3. Read a rule to nearest sixteenth of an inch.
4. Measure objects to the nearest sixteenth of an inch.
5. Draw lines and objects to specified dimensions.

MEASURING
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Make transparencies.

   B. Provide students with objective sheet.

   C. Discuss unit and specific objectives.

   D. Provide students with information and assignment sheets.

   E. Discuss information and assignment sheets.

   F. Emphasize importance of measuring accurately in tile work.

   G. Provide different sizes of ceramic tile for students to measure.

   H. Provide rooms or spaces in rooms for students to practice measuring.

   I. Give test after students have completed unit and assignments.

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Transparency masters

      1. TM #1--Graduations on a Rule

      2. TM #2--Reading the Eighths Rule

      3. TM #3--Reading the Sixteenths Rule

   E. Assignment sheets

      1. Assignment Sheet #1--Read a Rule to Nearest Sixteenth of an Inch

      2. Assignment Sheet #2--Measure Objects to the Nearest Sixteenth of an Inch

      3. Assignment Sheet #3--Draw Lines and Objects to Specified Dimensions

SUGGESTED ACTIVITIES

   F. Answers to assignment sheets

   G. Test

   H. Answers to test

III. Unit references

   A. McDonnell, Leo P. *Hand Woodworking Tools.* Albany, New York: Delmar Publishers, 1962.

   B. *Stanley Tool Guide.* New Britain, Connecticut: Division of Stanley Works, Educational Department, Stanley Tools, 1972.

MEASURING
UNIT IV

INFORMATION SHEET

I. Terms and definitions

   A. Measuring--Setting of limits or bounds according to a predetermined standard

   B. Inch (")--Smallest whole unit of linear measure commonly used in construction

   C. Foot (')--Unit of measure consisting of twelve equal parts called inches

   D. Fraction--One or more equal parts of a whole

   EXAMPLES: 1/2, 1/4, 3/8, 5/16

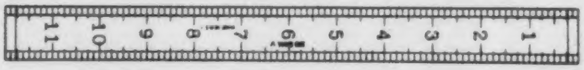
   E. Rule--Instrument graduated in whole units and fractions of units; used in measuring

   F. Dimension--Number of full units and fractions of units between two points

II. Basic measuring tools used by the tile setter (Figures 1-5)

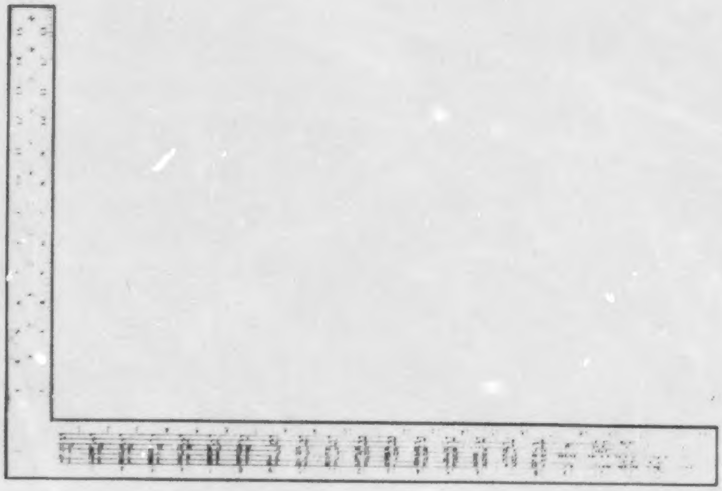
   A. Bench rule

FIGURE 1



   B. Steel square

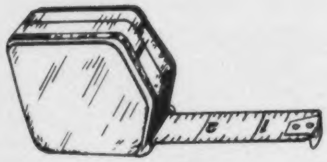
FIGURE 2



INFORMATION SHEET

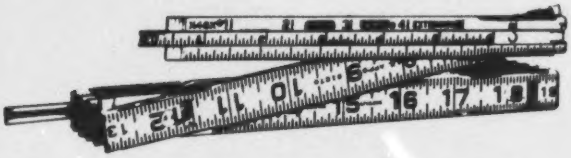
C. Steel tape

FIGURE 3



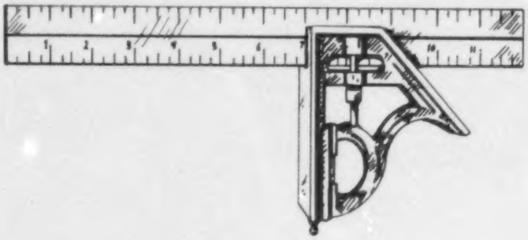
D. Wood folding rule

FIGURE 4



E. Combination square

FIGURE 5



III. Reading a rule to nearest fraction of an inch (Transparencies #1-#3; Assignment Sheets #1-#3)

(NOTE: All rules read similarly. Some rules are graduated with more divisions per inch than others. Layout tapes are marked sixteen inches on center.)

A. Find the number of graduations per inch

EXAMPLE: Locate small figure at "0" end of rule which shows divisions per inch; count divisions in one inch.

(NOTE: With continued practice, a worker recognizes on sight the graduations per inch on a rule.)

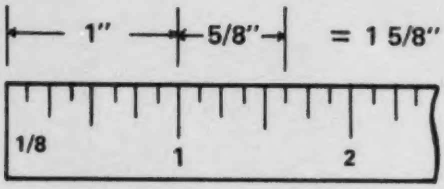
INFORMATION SHEET

B. Determine inches and fractions of an inch

1. Count the graduations in that fraction of an inch beyond the last full inch (Figure 6)

   EXAMPLE:

FIGURE 6



2. Add this fraction to the last full inch

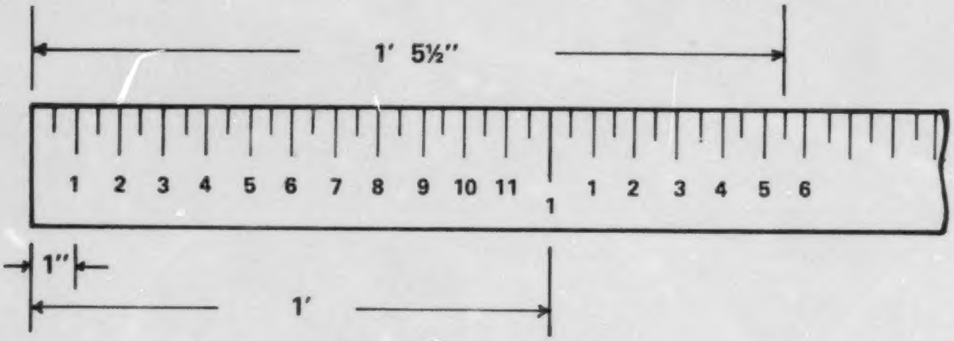
   (NOTE: In the example above, the total amount equals 1 5/8".)

3. Reduce the fraction if possible

4. Add inches and fraction of an inch to feet to obtain a correct measurement (Figure 7)

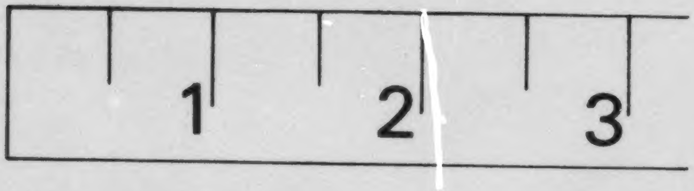
   EXAMPLE:

FIGURE 7

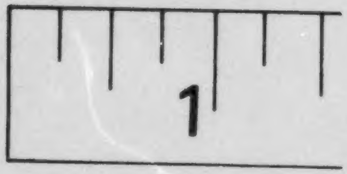


Graduations on a Rule

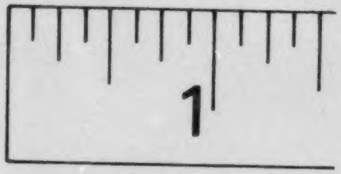
Halves



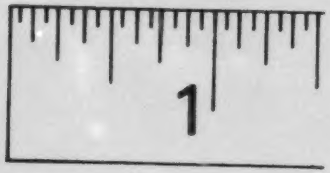
Quarters



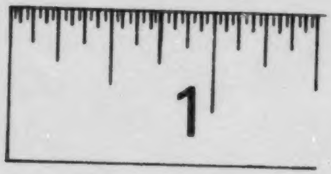
Eighths

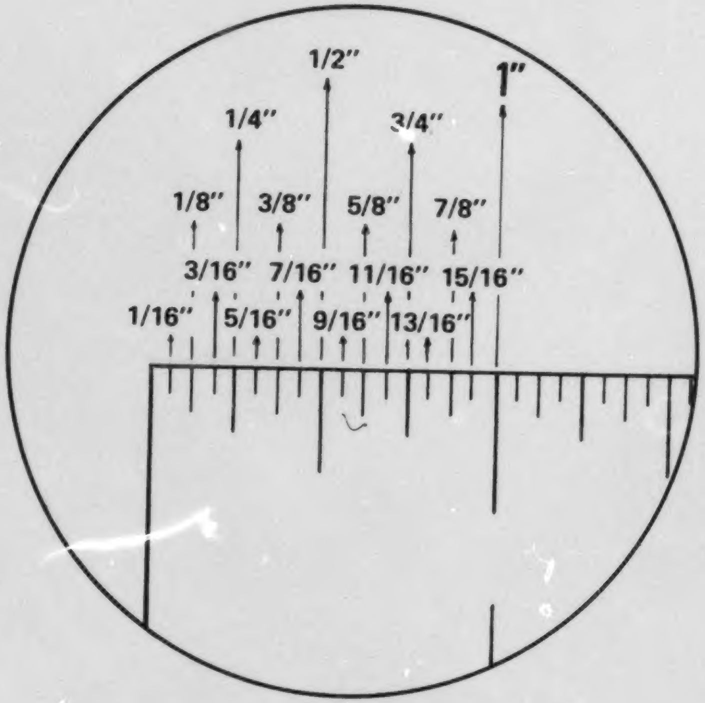


Sixteenths



Thirty-Seconds



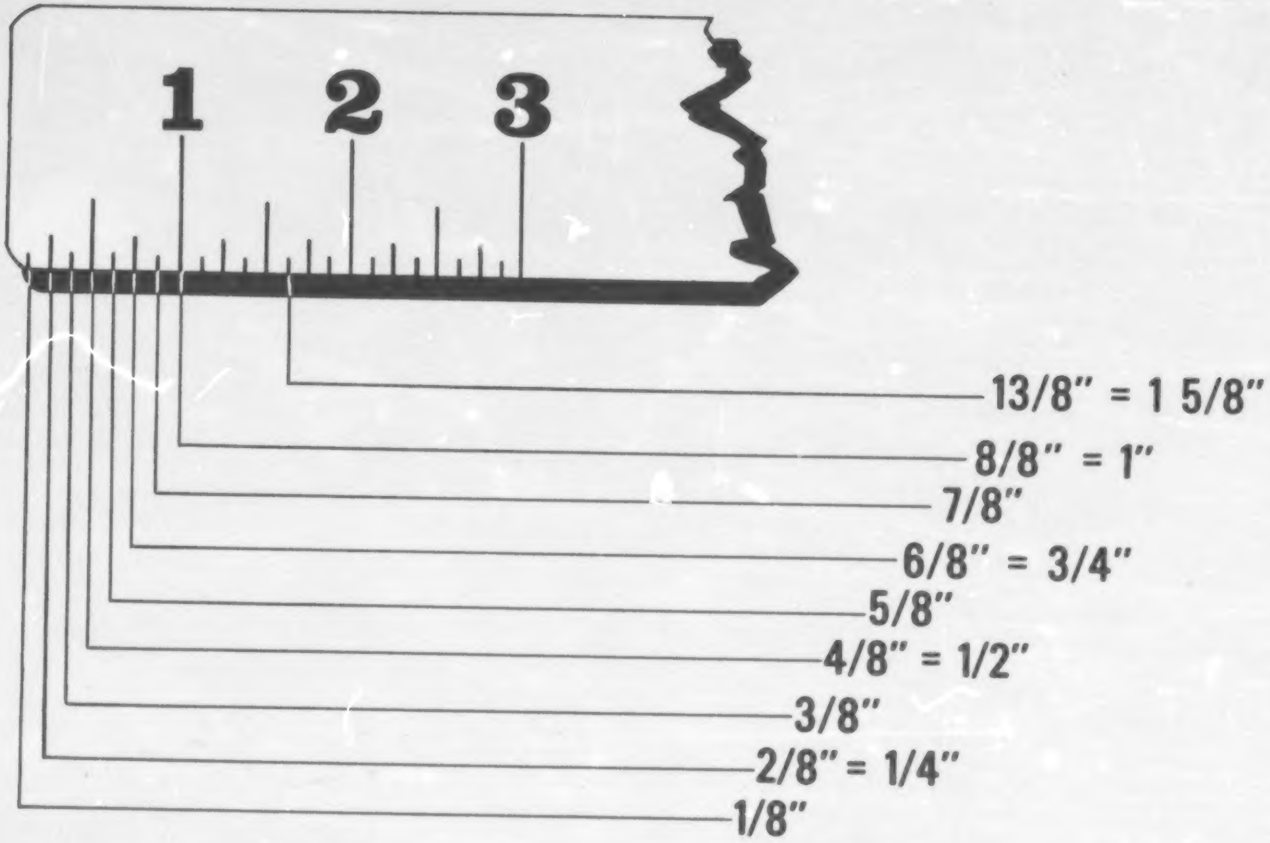

1/2"
1"
1/4"
3/4"
1/8"
3/8"
5/8"
7/8"
3/16"
7/16"
11/16"
15/16"
1/16"
5/16"
9/16"
13/16"

Graduations Applied to a Rule

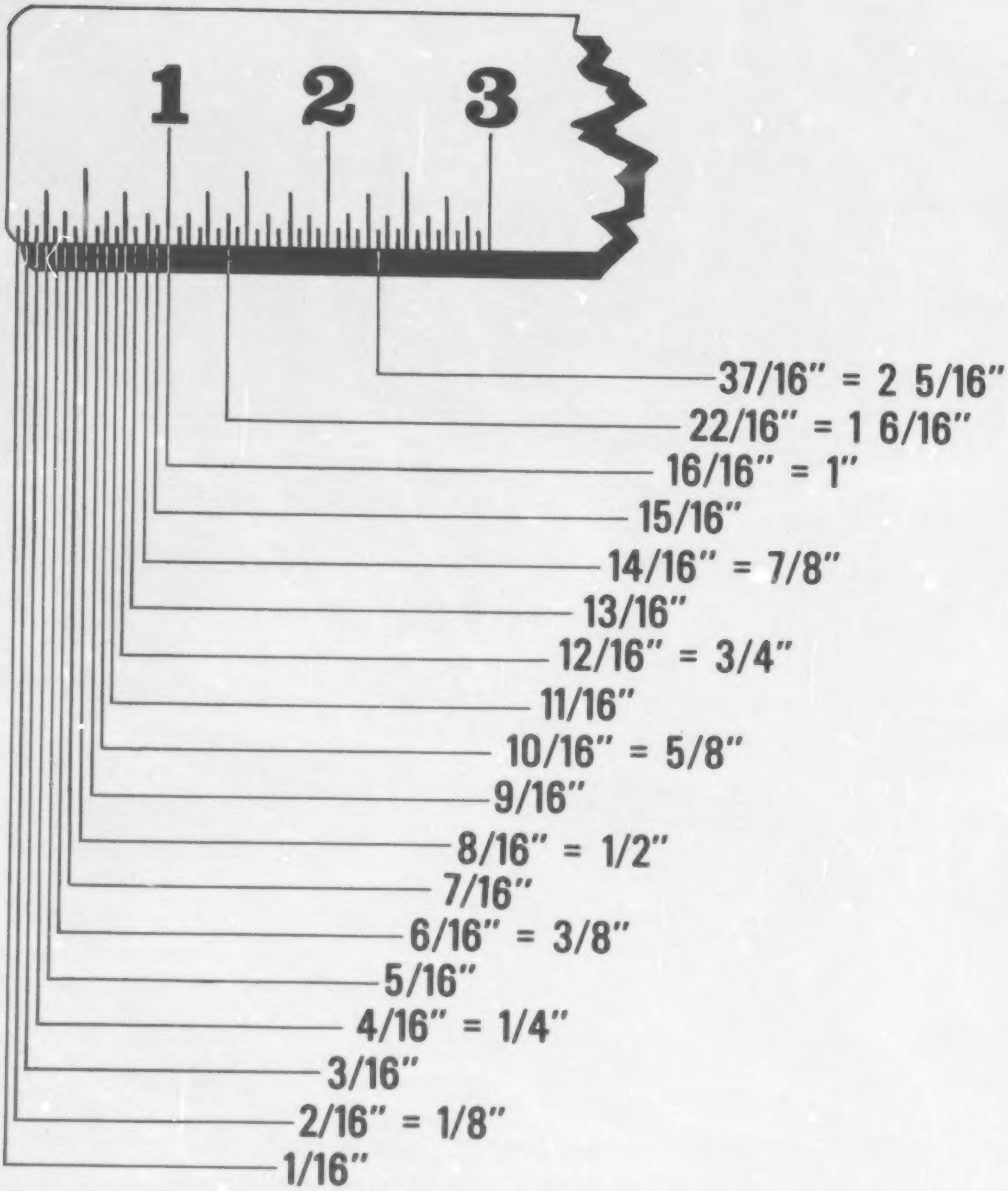
TM #1

CT - 279-A

Reading the Eighths Rule


1
2
3
13/8" = 1 5/8"
8/8" = 1"
7/8"
6/8" = 3/4"
5/8"
4/8" = 1/2"
3/8"
2/8" = 1/4"
1/8"

Reading the Sixteenths Rule


1
2
3
37/16" = 2 5/16"
22/16" = 1 6/16"
16/16" = 1"
15/16"
14/16" = 7/8"
13/16"
12/16" = 3/4"
11/16"
10/16" = 5/8"
9/16"
8/16" = 1/2"
7/16"
6/16" = 3/8"
5/16"
4/16" = 1/4"
3/16"
2/16" = 1/8"
1/16"

MEASURING
UNIT IV

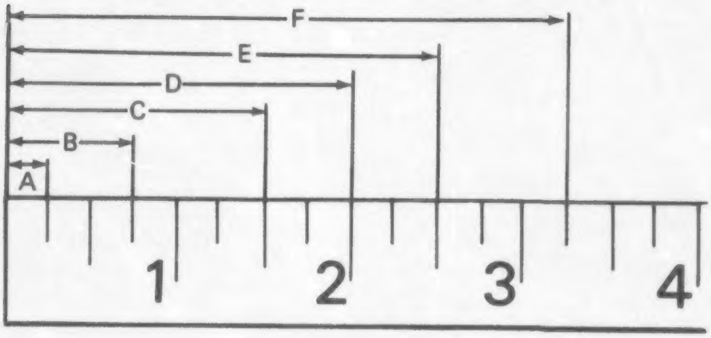
ASSIGNMENT SHEET #1--READ A RULE TO NEAREST SIXTEENTH OF AN INCH

NAME ______________________________ SCORE ______________

Reading a rule accurately is a basic skill used in the tile industry. In this assignment you will practice reading a rule to the nearest fourth, eighth, and sixteenth of an inch.

PART I

Read this rule in to the nearest one-fourth inch.



A. ______________________

B. ______________________

C. ______________________

D. ______________________

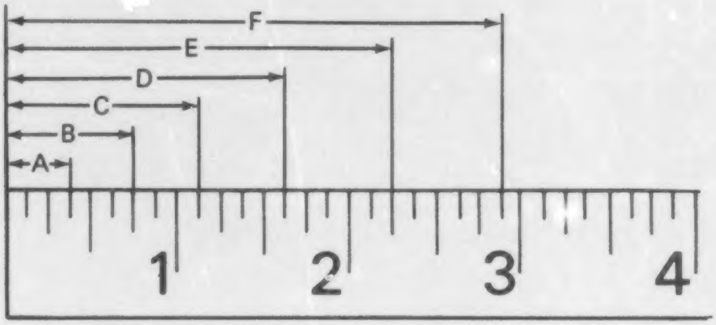
E. ______________________

F. ______________________

ASSIGNMENT SHEET #1

PART II

Read this rule in to the nearest one-eighth inch.


F
E
D
C
B
A
1
2
3
4

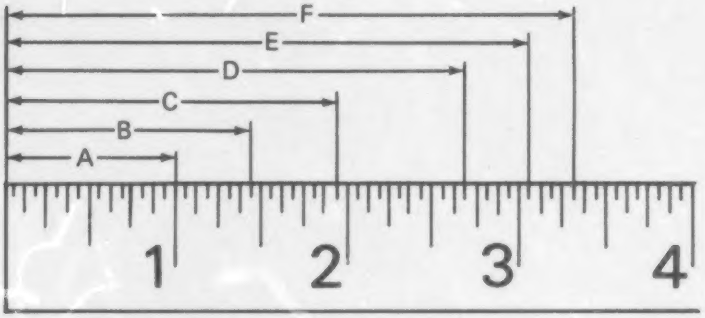
A. ______________________ D. ______________________

B. ______________________ E. ______________________

C. ______________________ F. ______________________

PART III

Read this rule in to the nearest one-sixteenth inch.


F
E
D
C
B
A
1
2
3
4

A. ______________________ D. ______________________

B. ______________________ E. ______________________

C. ______________________ F. ______________________

CT - 287-A

MEASURING
UNIT IV

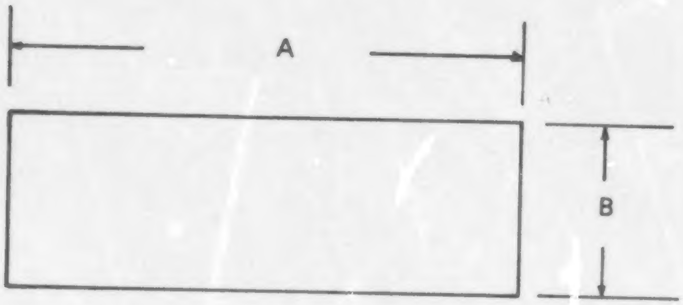
ASSIGNMENT SHEET #2--MEASURE OBJECTS TO THE NEAREST SIXTEENTH OF AN INCH

NAME ______________________________ SCORE ______________

Using basic measuring tools to measure rooms or spaces in rooms is a common task of the tile setter. In this assignment you will be measuring objects and recording their dimensions to the nearest sixteenth of an inch.

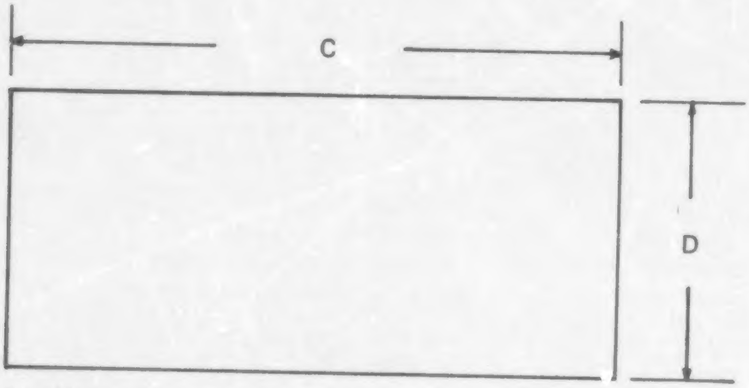
PART I

Using a rule with one-sixteenth inch graduations, measure the following objects.



A. Length = __________

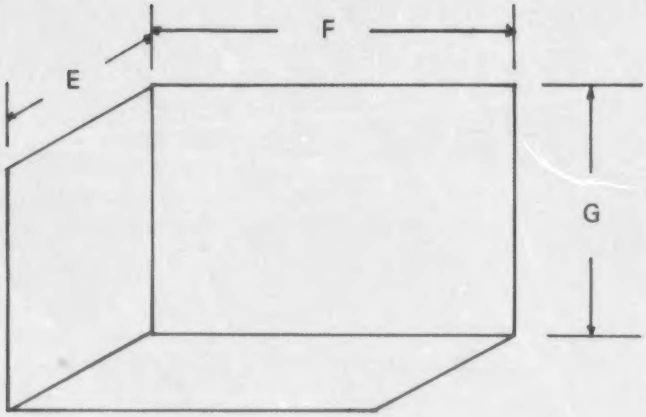
B. Height = __________



C. Length = __________

D. Height = __________

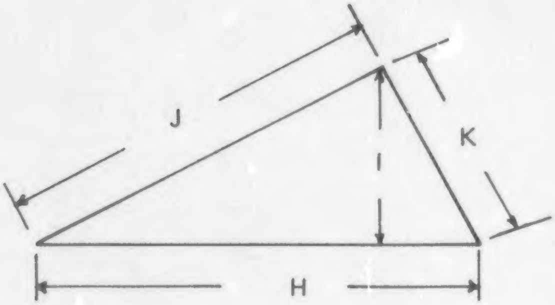
ASSIGNMENT SHEET #2



E. Slope E = ____________

F. Length = ____________

G. Height = ____________



H. Base = ____________

I. Height = ____________

J. Slope J = ____________

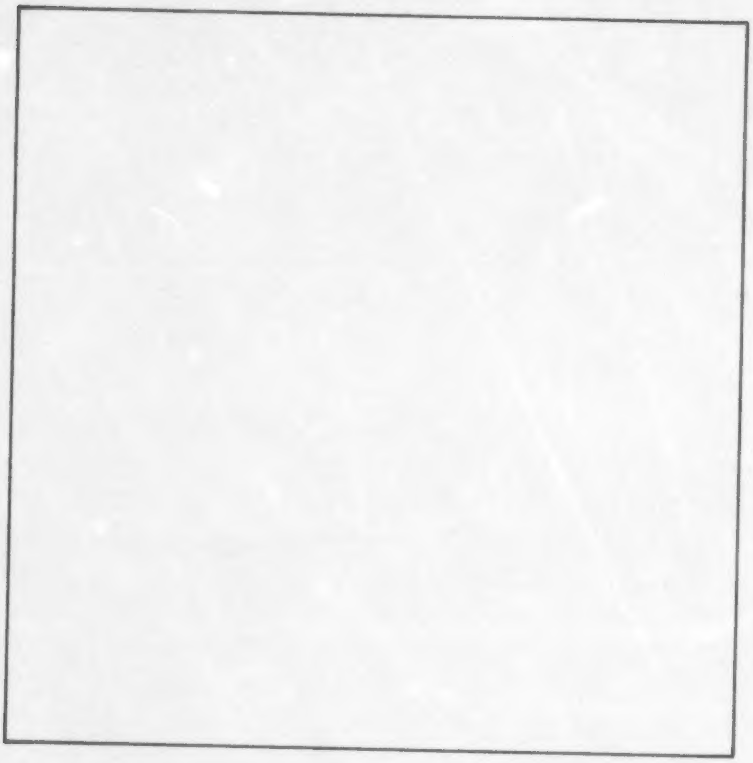
K. Slope K = ____________

ASSIGNMENT SHEET #2

PART II

Using a rule with one-sixteenth inch graduations, measure each of the following objects. Each drawing represents a tile dimension.

A. Glazed wall tile



1. Length = ____________________

2. Height = ____________________

ASSIGNMENT SHEET #2

B. Glazed wall tile

1. Length = ____________________

2. Height = ____________________

ASSIGNMENT SHEET #2

C. Mosaic tile

1. Length = ____________________

2. Height = ____________________

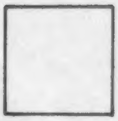
D. Quarry tile

1. Length = ____________________

2. Height = ____________________

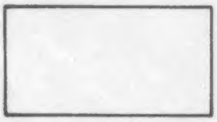
ASSIGNMENT SHEET #2

E. Mosaic tile



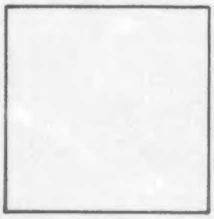
1. Length = ____________________
2. Height = ____________________

F. Mosaic tile



1. Length = ____________________
2. Height = ____________________

G. Mosaic tile



1. Length = ____________________
2. Height = ____________________

MEASURING
UNIT IV

ASSIGNMENT SHEET #3--DRAW LINES AND OBJECTS TO SPECIFIED DIMENSIONS

NAME_______________________________ SCORE _______________

Using basic measuring tools to draw lines is a skill often used by a tile setter. In order to draw lines to specified dimensions, you must be able to read a rule accurately and use a rule to measure objects accurately. In this assignment you will be using one or more of the basic measuring tools to draw lines and objects to specified dimensions.

A. Draw straight lines to the following lengths:

1. 3 3/4"

2. 2 1/16"

3. 3 5/8"

4. 1 1/4"

5. 2 5/8"

ASSIGNMENT SHEET #3

B. Draw a rectangle with a height of 1 7/8" and a length of 2 3/16".

C. Draw a triangle with a base length of 2 1/2", a height of 1 1/2", and one slope of 2 1/8".

MEASURING
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

PART I

A. 1/4"

B. 3/4"

C. 1 1/2"

D. 2"

E. 2 1/2"

F. 3 1/4"

PART II

A. 3/8"

B. 3/4"

C. 1 1/8"

D. 1 5/8"

E. 2 1/4"

F. 2 7/8"

PART III

A. 1"

B. 1 7/16"

C. 1 15/16"

D. 2 11/16"

E. 3 1/16"

F. 3 5/16"

Assignment Sheet #2

PART I

A. 3"

B. 1"

ANSWERS TO ASSIGNMENT SHEETS

C. 3 9/16"

D. 1 5/8"

E. 1"

F. 2 1/8"

G. 1 7/16"

H. 2 9/16"

I. 1 1/16"

J. 2 1/4"

K. 1 3/16"

PART II

A. 1. 4 1/4"
    2. 4 1/4"

B. 1. 6"
    2. 6"

C. 1. 1 11/16"
    2. 1 7/8"

D. 1. 2 3/4"
    2. 2 3/4"

E. 1. 5/8"
    2. 5/8"

F. 1. 5/8"
    2. 1 3/16"

G. 1. 1 3/16"
    2. 1 3/16"

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #3

A. 1. 3 3/4"

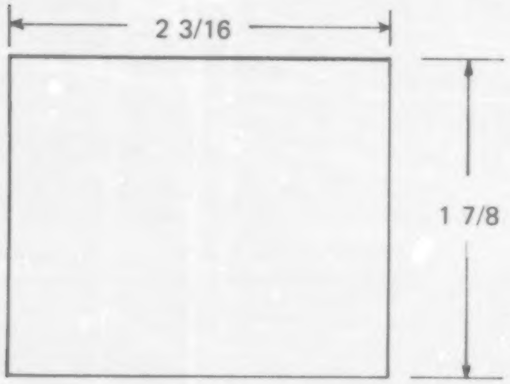
2. 2 1/16"

3. 3 5/8"

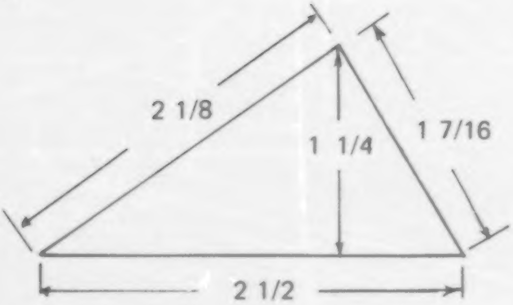
4. 1 1/4"

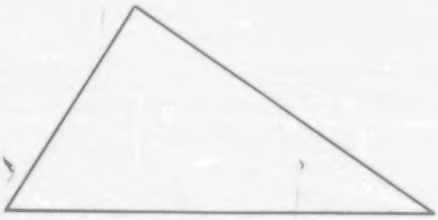
5. 2 5/8"

B.



C.


2 1/8
1 1/4
1 7/16
2 1/2



This is also a correct triangle for C.

MEASURING
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match measuring terms to their correct definitions. Write the correct numbers in the blanks.

_____a. Setting of limits or bounds according to a predetermined standard

_____b. Smallest whole unit of linear measure commonly used in construction

_____c. Unit of measure consisting of twelve equal parts called inches

_____d. One or more equal parts of a whole

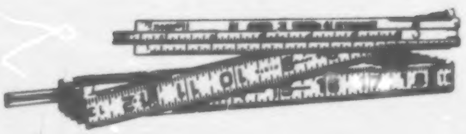
_____e. Instrument that is graduated in whole units and fractions of units; used in measuring

_____f. Number of full units and fractions of units between two points

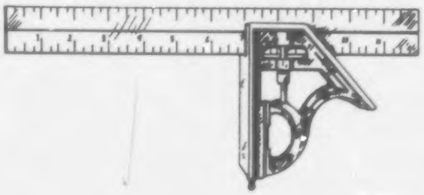
1. Measuring
2. Rule
3. Foot (')
4. Dimension
5. Inch (")
6. Fraction

2. Identify basic measuring tools used by the tile setter. Write the correct names in the blanks.

Bench rule
Steel square
Steel tape
Wood folding rule
Combination square

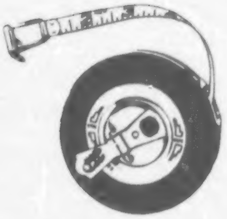


a. ______________________

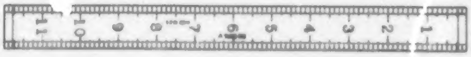


b. ______________________

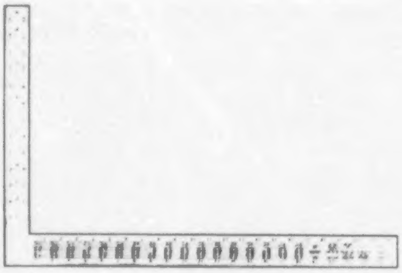
TEST



c. ______________________________

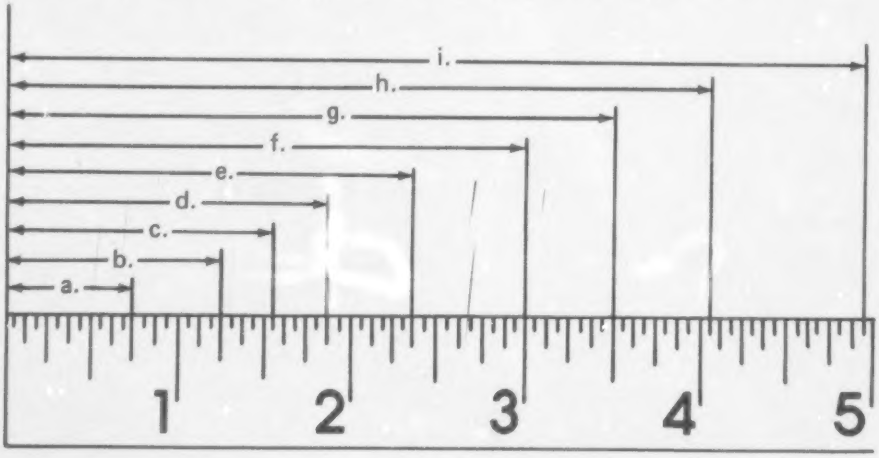

11
10
9
8
7
6
5
4
3
2
1

d. ______________________________



e. ______________________________

3. Read the rule pictured below to the nearest sixteenth of an inch.


i.
h.
g.
f.
e.
d.
c.
b.
a.
1
2
3
4
5

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

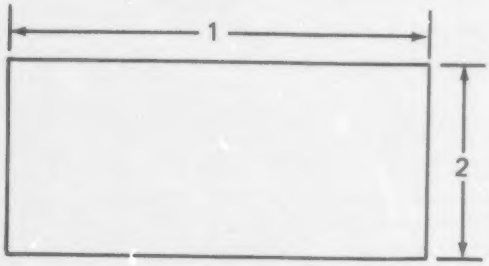
h. ______________________________

i. ______________________________

TEST

4. Measure the following objects to the nearest sixteenth of an inch.

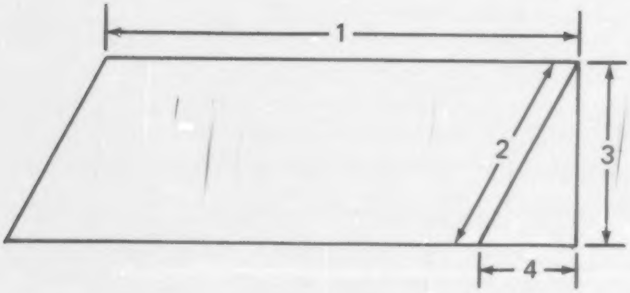
a.



1) ____________

2) ____________

b.



1) ____________

2) ____________

3) ____________

4) ____________

TEST

5. Draw lines and objects to their specified dimensions.

   a. Draw a 1 7/8" square.

   b. Draw a rectangle 1 5/8" x 2 1/4".

   c. Draw a triangle with a base line of 2", a height of 7/8", and one slope of 15/16".

MEASURING
UNIT IV

ANSWERS TO TEST

1. a. 1
   b. 5
   c. 3
   d. 6
   e. 2
   f. 4

2. a. Wood folding rule
   b. Combination square
   c. Steel tape
   d. Bench rule
   e. Steel square

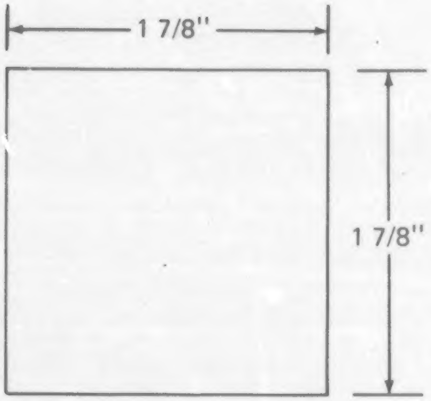
3. a. 3/4"
   b. 1 1/4"
   c. 1 9/16"
   d. 1 7/8"
   e. 2 3/8"
   f. 3"
   g. 3 1/2"
   h. 4 1/16"
   i. 4 15/16"

4. a. 1) 2 7/16"
      2) 1 1/8"

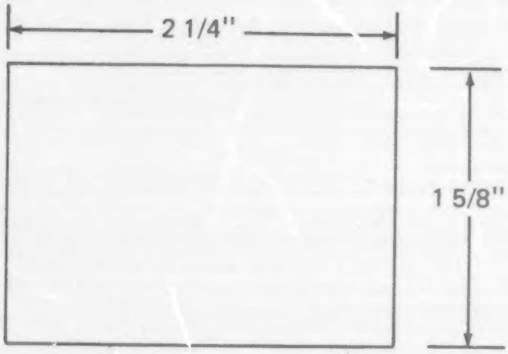
   b. 1) 2 3/4"
      2) 1 3/16"
      3) 1 1/16"
      4) 9/16"

ANSWERS TO TEST

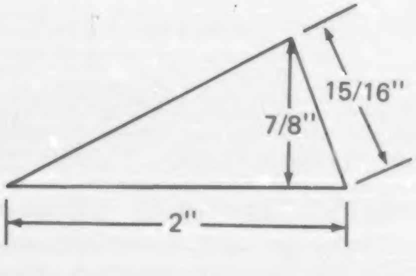
5. a.

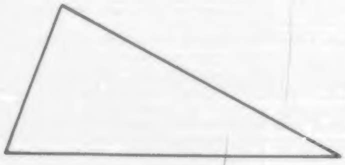


b.



c.





This is also a correct triangle for 5c.

SAFETY IN TILE SETTING
UNIT V

UNIT OBJECTIVE

After completing this unit, the student should be able to practice personal and general job safety while performing tilesetting duties. This knowledge will be shown by completing assignment sheets, job sheets, and unit test with a minimum score of 100 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with safety and first aid.
2. State reasons for practicing job safety.
3. State personal safety guidelines.
4. State rules for general job safety.
5. Describe procedures used to maintain a clean and orderly work area.
6. Describe special safety hazards of the tilesetting trade.
7. Select from a list safe work practices associated with use of materials needed in installation, repair, renovation, and maintenance of ceramic tile.
8. State safety rules concerning use of flammable liquids.
9. Select from a list procedures used to lift heavy objects correctly.
10. Interpret labels of products used by tile setters.
11. Demonstrate the ability to lift a heavy object properly.

SAFETY IN TILE SETTING
UNIT V

SUGGESTED ACTIVITIES

I. Suggested activities

A. To supplement unit, order films which stress the importance of safety.

1. *Housekeeping Means Safekeeping.* Color, 10 minutes, Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.
2. *Stop a Fire Before it Starts.* Color, 10 minutes, Journal Films, Inc., 1975. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.
3. *A New Way to Lift.* Color, 9 minutes, Journal Films, Inc., 1970. Available from Journal Films, Inc., 930 Pitner Ave., Evanston, Illinois 60202.
4. *It Always Happens to the Other Guy.* Color, 21 minutes, Modern Talking Picture Service, 1980. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.
5. *The Industrial Weight Lifter.* Color, 12 minutes, Ruddel Films for Industrial Accident Prevention Association Ontario and Canada Packers Ltd., 1965. Available from International Film Bureau, Inc., 332 South Michigan Avenue, Chicago, Illinois 60604.

B. Make transparency.

C. Provide students with objective sheet.

D. Provide students with information, assignment, and job sheets.

E. Discuss unit and specific objectives.

F. Discuss information and assignment sheets.

G. Demonstrate and discuss procedures outlined in job sheet.

H. Lead a discussion using the following ideas:

1. Tile setting may not appear to be a particularly hazardous trade.
2. Equipment used by tile setters offers a variety of hazards.
3. Each worker must develop safety awareness.

I. Gather various ceramic tile products so that students may complete Assignment Sheet #2.

J. Obtain actual accident reports involving tile setters for students to review and analyze.

K. Give test after students have completed unit and assignments.

SUGGESTED ACTIVITIES

II. Instructional materials

  A. Objective sheet

  B. Suggested activities

  C. Information sheet

  D. Transparency master: TM #1--Correct Way to Lift Heavy Objects

  E. Assignment sheets

    1. Assignment Sheet #1--Complete a Safety Pledge Form

    2. Assignment Sheet #2--Interpret Labels of Products Used by Tile Setters

  F. Answers to assignment sheets

  G. Job Sheet #1--Lift a Heavy Object Properly

  H. Test

  I. Answers to test

III. Unit references

  A. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator,* Vol. I. Stillwater, Oklahoma: State Department of Vocational and Technical Education/ Curriculum and Instructional Material Center and Associated General Contractors of America, 1981.

  B. *Tilesetting Workbook.* Sacramento, California: California State Department of Education, 1975.

SAFETY IN TILE SETTING
UNIT V

INFORMATION SHEET

I. Terms and definitions

A. Safety--State or condition of being safe; freedom from danger, risk, or injury

B. Accident--Any suddenly occurring, unintentional event which causes injury or property damage

C. First aid--Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

D. Occupational Safety and Health Act (OSHA)--Federal legislation designed to ensure safe and sanitary working conditions for employees

E. Flammable--Capable of being easily ignited and burning very quickly

F. Explosive--Capable of bursting violently as a result of pressure or of releasing immense energy due to rapid combustion

G. Combustible--Capable of bursting into flames

H. Extinguish--To cause to cease burning

I. Pressurized--Stored under pressure greater than the pressure of the atmosphere

J. Solvent--Liquid substance capable of dissolving or dispersing one or more other substances

K. Scaffold--Temporary platform for workers to stand or sit on when working above the floor or ground

L. Hazard--Source of danger

II. Reasons for practicing job safety

A. Preventing physical harm to yourself and others

B. Avoiding lost work hours

C. Avoiding possible loss of pay

D. Lowering cost to employer

E. Preventing loss of or damage to equipment or materials

F. Lowering insurance rates

G. Preventing hardship on family

INFORMATION SHEET

H. Providing regular job schedules

I. Preventing possible loss of job

III. Personal safety guidelines

A. Wear clothing that is appropriate for the activity being performed

EXAMPLES: Pant legs with torn, bulky, or turned-up cuffs may catch on objects and cause a fall; shoes that have thick soles and good heels reduce possibility of stumbling or slipping; clothing should protect against toxic or irritating materials.

B. Wear rubber-soled shoes and rubber gloves while working on wet surfaces

C. Wear safety glasses to protect against flying chips and fine cement dust

D. Wash hands thoroughly after using epoxies and adhesives, particularly before eating

E. Remove ties and fasten loose sleeves when working around machine tools or rotating equipment

F. Remove rings and other jewelry when working

G. Confine long hair before operating moving or rotating equipment

H. Be familiar with location of first-aid equipment

IV. Rules for general job safety

A. Keep all tools sharp, clean, and in safe working order

B. Any tool not in use should be returned to tool box or put aside in a safe place

C. Retain guards and safety devices on all equipment

D. Report to supervisor defective tools, machines, or other equipment

E. Report all accidents to the supervisor, regardless of nature or severity

F. Be sure machine and equipment operators turn off power and do not leave until equipment has stopped

G. Clean up any spilled liquids immediately

H. Keep work area clear of litter; store waste in proper containers

I. Do not use compressed air to clean yourself or your clothing

J. Be sure others are at a safe distance when operating moving equipment

INFORMATION SHEET

- K. Maintain all safety rules and limitations on equipment according to specifications and manufacturer's regulations
- L. Use only heavy-duty extension cords, and inspect them each time for damaged insulation and fittings
- M. Do not leave a cord where it may touch wet cement
- N. Make sure that portable electrical tools are well-grounded

V. Procedures used to maintain a clean and orderly work area

- A. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning
- B. Stock materials and supplies in their proper places
- C. Store tools and accessories in cabinets, on racks, or on other suitable devices
- D. Clear work areas of debris and other hazards
- E. Clean slippery substances from floor
- F. Dispose of materials properly
- G. Keep brooms, brushes, and other housekeeping equipment where they are readily available

VI. Special safety hazards of tilesetting trade (Assignment Sheet #1 and #2)

- A. Damp surfaces that may cause falls
- B. Wet mortar, which may contain active lime that can injure the eyes or skin
- C. Use of materials that are flammable, toxic, and irritating to the skin
- D. Use of potentially dangerous equipment particular to tilesetting

  EXAMPLES: Electric saws and drills, flammable adhesives and epoxies, scaffolding

  (NOTE: Little tile work in residences requires use of scaffold.)

VII. Safe work practices associated with use of materials needed in installation, repair, renovation, and maintenance of ceramic tile (Assignment Sheet #2)

- A. Keep all materials properly labeled
- B. Read labels carefully
- C. Use materials in areas where ventilation is adequate, and avoid prolonged breathing of fumes

INFORMATION SHEET

D. Avoid prolonged contact with skin; if any of the material contacts skin, wash immediately with plenty of water

E. Avoid using materials in areas with an open flame

F. Wash hands thoroughly after using materials, particularly before eating

G. Dispose of containers for caustic or dangerous materials in accordance with manufacturer's instructions

VIII. Safety rules concerning use of flammable liquids (Assignment Sheet #2)

A. Know the location and use of fire extinguishers for flammable liquids

B. Store all flammable liquids in approved safety containers

C. Use only approved cleaning solvents

D. Avoid use of flammable materials in room that contains an open flame

IX. Procedures used to lift heavy objects correctly (Transparency #1; Job Sheet #1)

A. Step up to object with feet apart; place one foot beside object and one behind

B. Lift with legs and not with the back

C. Keep back straight, nearly vertical

D. Tuck chin in

E. Grasp object with whole hand

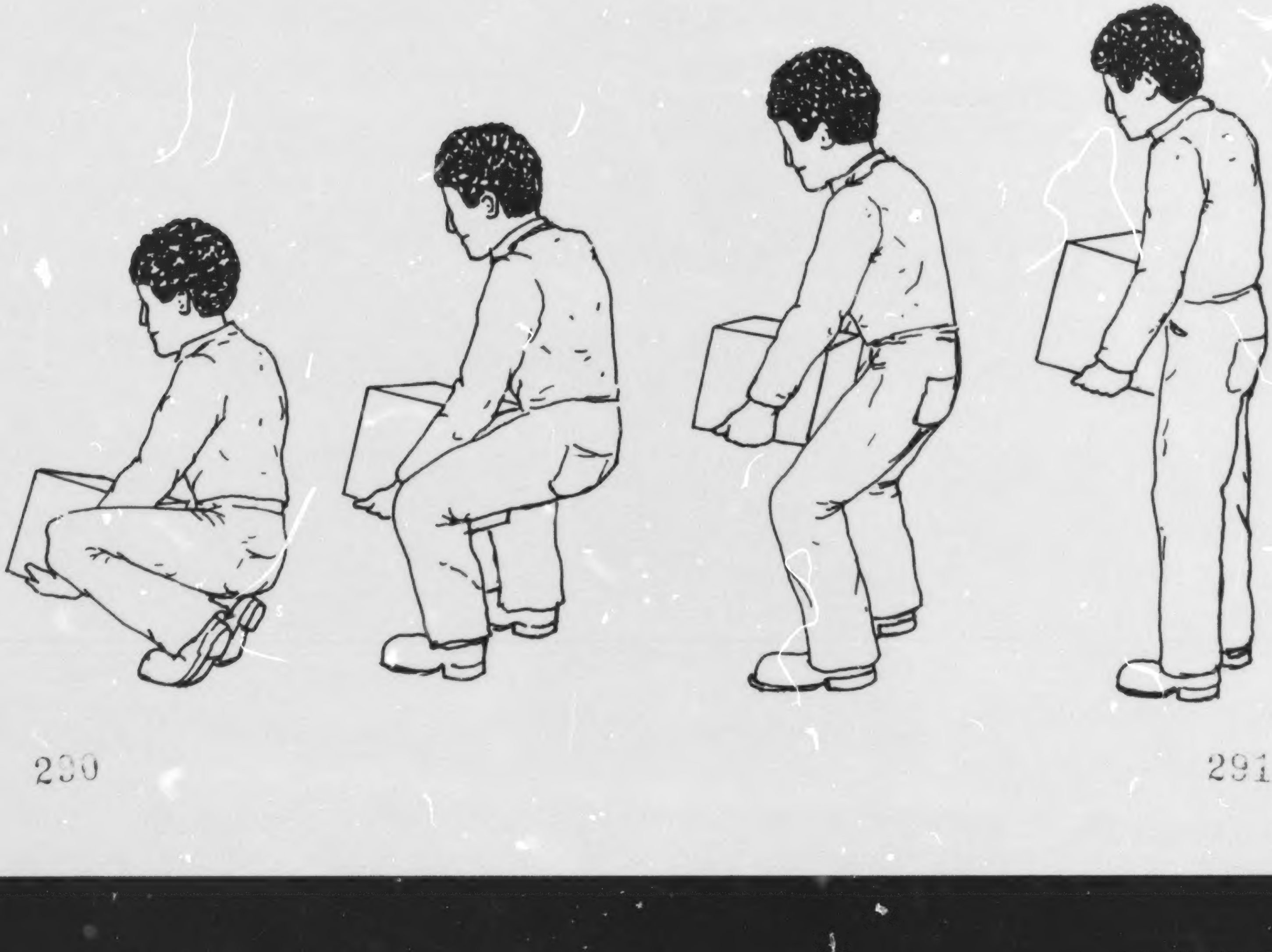
F. Tuck elbows and arms in

G. Hold load close to body

H. Keep body weight directly over feet

(NOTE: Know your own physical capabilities and limits.)

Correct Way to Lift Heavy Objects



TM #1

CT-313-A

SAFETY IN TILE SETTING
UNIT V

ASSIGNMENT SHEET #1--COMPLETE A SAFETY PLEDGE FORM

NAME ______________________________ SCORE ______________

It is understood that each student and/or employee will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it. You must assume responsibility for following safe practices. We, therefore, ask that you subscribe to the following safety pledge.

A. I will follow all safety rules.

B. I will never use tools, machinery, or equipment without first having permission and/or instruction from the instructor.

C. I will use procedures to maintain a clean and orderly work area.

D. I will follow safety rules concerning flammable liquids.

E. I will follow safe work practices while using materials needed in installation, repair, renovation, and maintenance of ceramic tile.

F. I will lift heavy objects correctly.

G. I will report any accident or injury, no matter how minor, to my instructor or supervisor immediately.

Date ______________________

Student's and/or employee's signature ______________________________

Date ______________________

Supervisor's signature ______________________________

(Parental consent is necessary if the student/employee is under 18.)

Date ______________________

Parent's or guardian's signature ______________________________

SAFETY IN TILE SETTING
UNIT V

ASSIGNMENT SHEET #2--INTERPRET LABELS OF PRODUCTS USED BY TILE SETTERS

NAME ______________________________ SCORE ______________

One way to ensure safety is to read product labels carefully. Not only do labels contain information concerning use of the product, but also recommendations to follow when products have been misused.

To prevent damage to equipment and materials, and to avoid personal injury, a tile setter must be able to read and follow manufacturer's instructions printed on supply containers.

On the following sheets, write the requested information for any three ceramic tile products.

(NOTE: Some products will not list all of the requested information.)

ASSIGNMENT SHEET #2

PART I--LABEL INFORMATION

A. Type of product ____________________

B. Brand name ____________________

C. Manufacturer's name and address ____________________

D. Directions for use (amount to use and how to use) ____________________

E. Surfaces on which product can be used ____________________

F. Surfaces on which product should not be used ____________________

G. Caution statements ____________________

H. Net contents ____________________

I. List of ingredients ____________________

ASSIGNMENT SHEET #2

PART II--LABEL INFORMATION

A. Type of product ______________________________

B. Brand name ______________________________

C. Manufacturer's name and address ______________________________

D. Directions for use (amount to use and how to use) ______________________________

E. Surfaces on which product can be used ______________________________

F. Surfaces on which product should not be used ______________________________

G. Caution statements ______________________________

H. Net contents ______________________________

I. List of ingredients ______________________________

ASSIGNMENT SHEET #2

PART III--LABEL INFORMATION

A. Type of product ____________________

B. Brand name ____________________

C. Manufacturer's name and address ____________________

D. Directions for use (amount to use and how to use) ____________________

E. Surfaces on which product can be used ____________________

F. Surfaces on which product should not be used ____________________

G. Caution statements ____________________

H. Net contents ____________________

I. List of ingredients ____________________

SAFETY IN TILE SETTING
UNIT V

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1--Evaluated to the satisfaction of the instructor

Assignment Sheet #2--Evaluated to the satisfaction of the instructor

SAFETY IN TILE SETTING
UNIT V

JOB SHEET #1--LIFT A HEAVY OBJECT PROPERLY

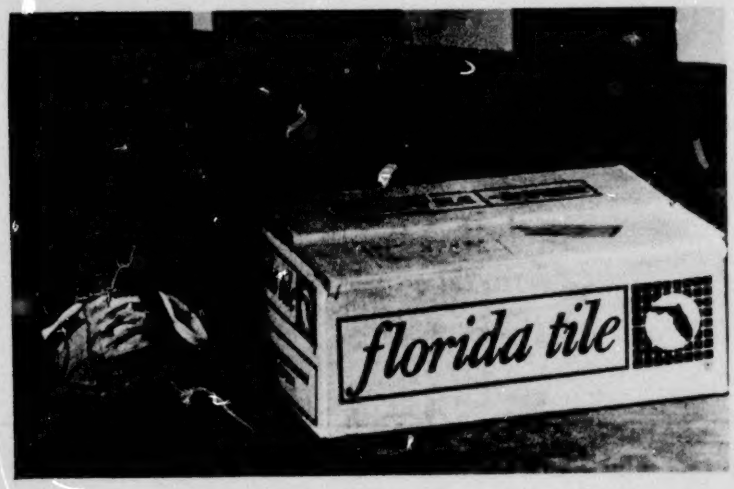
(NOTE: It is understood that each student will be given proper instructions on lifting before attempting to lift a heavy object. It is also advised that students view the film *A New Way to Lift.*)

I. Equipment--Heavy object

II. Procedure

A. Step up to object with feet apart; place one foot beside object and one behind (Figure 1)

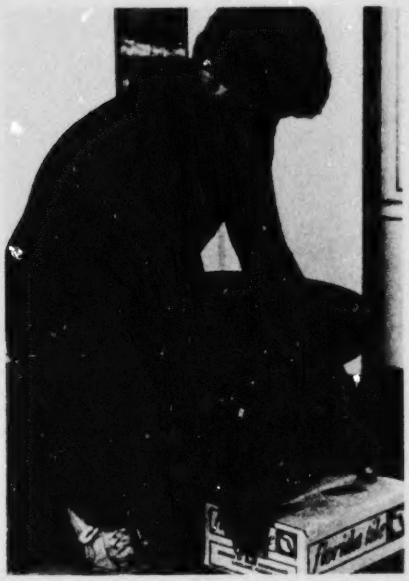
FIGURE 1



JOB SHEET #1

B. Keep back straight (Figure 2)

FIGURE 2



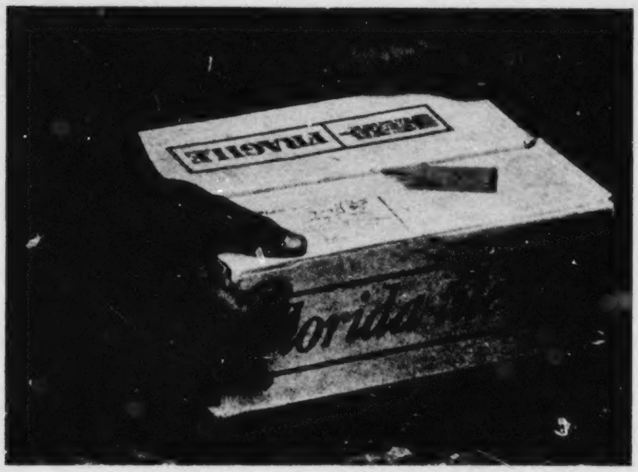
C. Tuck chin in (Figure 3)

FIGURE 3

JOB SHEET #1

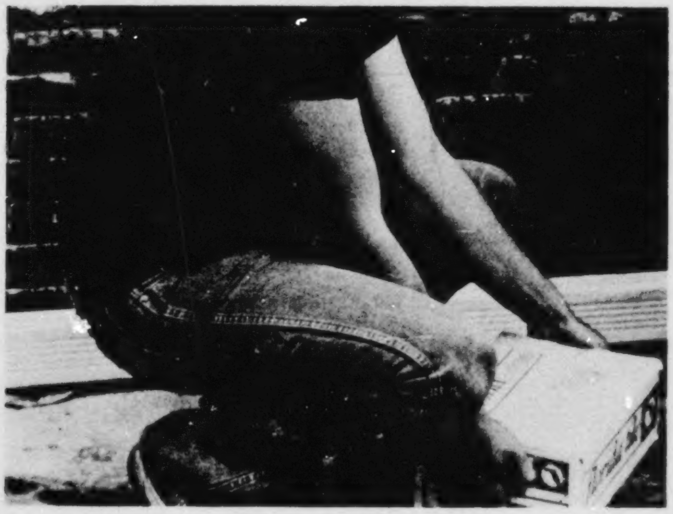
D. Grasp object with whole hand (Figure 4)

FIGURE 4



E. Tuck in elbows and arms, and hold load close to body (Figure 5)

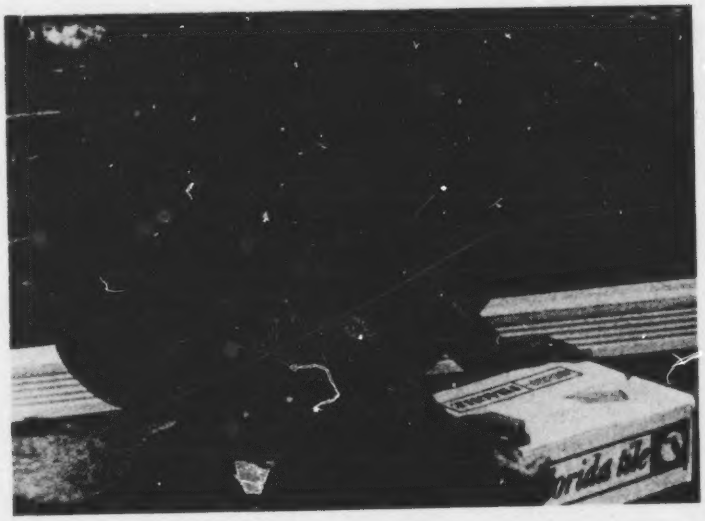
FIGURE 5



JOB SHEET #1

F. Keep body weight directly over feet (Figure 6)

FIGURE 6



G. Lift object (Figure 7)

FIGURE 7

SAFETY IN TILE SETTING
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with safety and first aid. Write the correct numbers in the blanks.

_____ a. Capable of bursting violently as a result of pressure or of releasing immense pressure due to rapid combustion

_____ b. Any suddenly occuring, unintentional event which causes injury or property damage

_____ c. Federal legislation designed to ensure safe and sanitary working conditions for employees

_____ d. Capable of being easily ignited and burning very quickly

_____ e. State or condition of being safe; freedom from danger, risk, or injury

_____ f. Capable of bursting into flames

_____ g. To cause to cease burning

_____ h. Stored under pressure greater than the pressure of the atmosphere

_____ i. Liquid substance capable of dissolving or dispersing one or more other substances

_____ j. Temporary platform for workers to stand or sit on when working above the floor or ground

_____ k. Source of danger

_____ l. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

1. Pressurized
2. Safety
3. Combustible
4. First aid
5. Solvent
6. Accident
7. Explosive
8. Extinguish
9. Occupational Safety and Health Act (OSHA)
10. Flammable
11. Scaffold
12. Hazard

TEST

2. State five reasons for practicing job safety.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

3. State five personal safety guidelines.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

4. State seven rules for general job safety.

   a. ____
   ____

   b. ____
   ____

   c. ____
   ____

   d. ____
   ____

   e. ____
   ____

   f. ____
   ____

   g. ____
   ____

TEST

5. Describe procedures used to maintain a clean and orderly work area.

6. Describe special safety hazards of the tilesetting trade.

TEST

7. Select from the following list safe work practices associated with use of materials needed in installation, repair, renovation, and maintenance of ceramic tile. Write an "X" in the blank before each correct answer.

_____a. Keep all materials properly labeled

_____b. Read labels carefully

_____c. Always wear cloth gloves when handling adhesives

_____d. Use materials in areas where ventilation is adequate, and avoid prolonged breathing of fumes

_____e. Place adhesives in warm area on job site so that they will stay flexible

_____f. Avoid contacting metal surfaces with adhesive; if metal is contacted, remove adhesive with petroleum jelly

_____g. Avoid prolonged contact with skin; if any of the material contacts skin, wash immediately with plenty of water

_____h. Dispose of containers for caustic or dangerous materials in accordance with manufacturer's instructions

_____i. Avoid using materials in areas with an open flame

_____j. Wash hands thoroughly after using materials, particularly before eating

8. State safety rules concerning use of flammable liquids.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

TEST

9. Select from the following list procedures used to lift heavy objects correctly. Write an "X" in the blank before each correct answer.

______a. Step up to object with feet apart; place one foot beside object and one behind

______b. Use a sharp jerk to get object moving

______c. Lift with legs and not with the back

______d. Hold head back with neck fully extended

______e. Keep back straight, nearly vertical

______f. Stand with legs well apart to provide firmer base

______g. Tuck chin in

______h. Grasp object with whole hand

______i. Turn body while lifting to increase power with torque

______j. Tuck elbows and arms in

______k. Hold arms fully extended for increased leverage

______l. Hold load close to body

______m. Keep body weight directly over feet

______n. Change position of feet and hands if object is impossible to lift on first attempt and try again

(NOTE: Test questions 10 and 11 list assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

10. Interpret labels of products used by tile setters.

11. Demonstrate the ability to lift a heavy object properly.

SAFETY IN TILE SETTING
UNIT V

ANSWERS TO TEST

1.

a.	7	g.	8
b.	6	h.	1
c.	9	i.	5
d.	10	j.	11
e.	2	k.	12
f.	3	l.	4

2. Answer should include any five of the following
   a. Preventing physical harm to yourself and others
   b. Avoiding lost work hours
   c. Avoiding possible loss of pay
   d. Lowering cost to employer
   e. Preventing loss of or damage to equipment or materials
   f. Lowering insurance rates
   g. Preventing hardship on family
   h. Providing regular job schedules
   i. Preventing possible loss of job

3. Answer should include any five of the following
   a. Wear clothing that is appropriate for the activity being performed
   b. Wear rubber-soled shoes and rubber gloves while working on wet surfaces
   c. Wear safety glasses to protect against flying chips and fine cement dust
   d. Wash hands thoroughly after using epoxies and adhesives, particularly before eating
   e. Remove ties and fasten loose sleeves when working around machine tools or rotating equipment
   f. Remove rings and other jewelry when working

ANSWERS TO TEST

g. Confine long hair before operating moving or rotating equipment

h. Be familiar with location of first-aid equipment

4. Answer should include any seven of the following

   a. Keep all tools sharp, clean, and in safe working order

   b. Any tool not in use should be returned to tool box or put aside in a safe place

   c. Retain guards and safety devices on all equipment

   d. Report to supervisor defective tools, machines, or other equipment

   e. Report all accidents to the supervisor, regardless of nature or severity

   f. Be sure machine and equipment operators turn off power and do not leave until equipment has stopped

   g. Clean up any spilled liquids immediately

   h. Keep work area clear of litter; store waste in proper containers

   i. Do not use compressed air to clean yourself or your clothing

   j. Be sure others are at a safe distance when operating moving equipment

   k. Maintain all safety rules and limitations on equipment according to specifications and manufacturer's regulations

   l. Use only heavy-duty extension cords, and inspect them each time for damaged insulation and fittings

   m. Do not leave a cord where it may touch wet cement

   n. Make sure that portable electrical tools are well-grounded

5. Description should include the following

   a. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning

   b. Stock materials and supplies in their proper places

   c. Store tools and accessories in cabinets, on racks, or on other suitable devices

ANSWERS TO TEST

d. Clear work areas of debris and other hazards

e. Clean slippery substances from floor

f. Dispose of materials properly

g. Keep broom, brushes, and other housekeeping equipment where they are readily available

6. Description should include the following

   a. Damp surfaces that may cause falls

   b. Wet mortar, which may contain active lime that can injure the eyes or skin

   c. Use of materials that are flammable, toxic, and irritating to the skin

   d. Use of potentially dangerous equipment particular to tilesetting

7. a, b, d, g, h, i, j

8. Answer should include the following

   a. Know the location and use of fire extinguishers for flammable liquids

   b. Store all flammable liquids in approved safety containers

   c. Use only approved cleaning solvents

   d. Avoid use of flammable materials in room that contains an open flame

9. a, c, e, g, h, j, l, m

10. Evaluated to the satisfaction of the instructor

11. Performance skills evaluated to the satisfaction of the instructor

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to evaluate materials used in tile installations for their intended purposes and uses. The student should be able to estimate amount of materials needed, interpret work orders, and interpret specifications and standards. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with tile installation materials and guidelines for use.
2. Name examples of places where ceramic tile can be used in residences.
3. Name factors affecting tile selection and installation.
4. Name major types of ceramic tile.
5. Describe types of glazes.
6. Label shapes of ceramic tile.
7. Match types of trim to their correct ordering numbers.
8. Match types of trim to their correct uses.
9. Distinguish between suitable prepared backings for thin-set installations in wet and dry areas.
10. Match setting materials used in thin-set installation methods to their correct descriptions.
11. Match types of grouts to their correct descriptions.
12. Select from a list guidelines for mixing and using grout.
13. Select from a list characteristics of good grouting.
14. State reasons for grout discoloration.
15. Select from a list ways to prevent grout discoloration.
16. Match special products used in tile installation to their correct definitions.

OBJECTIVE SHEET

17. Write meanings of abbreviations commonly used in tile industry.

18. State steps in material estimating.

19. Estimate amount of materials needed for tile installations.

20. Interpret a work order.

21. Interpret ANSI specifications and TCA *Handbook*.

22. Interpret labels from tile installation products.

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order materials which will assist students in becoming familiar with tile installation materials and guidelines.

1. *American National Standard Specifications for the Installation of Ceramic Tile, A-108.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

2. *Handbook for Ceramic Tile Installation.* Available from Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

3. *American National Standard Specifications for Ceramic Tile.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

4. Materials & Methods Standards Association (MMSA) *Bulletins.* Available from MMSA care of H.B. Fuller Company, 315 South Hicks Road, Palatine, Illinois 60067.

5. Ceramic Tile Institute (CTI) *Field Reports.* Available from Ceramic Tile Institute, 700 North Virgil Avenue, Los Angeles, California 90029.

6. Current trade magazines and newsletters, such as *Tile and Decorative Surfaces.*

B. Provide students with objective sheet.

C. Provide students with information and assignment sheets.

D. Discuss unit and specific objectives.

E. Discuss information and assignment sheets.

F. Refer to ANSI A108, ANSI A137.1, and MMSA Bulletin #8.

G. Discuss the great variety and number of places where ceramic tile can be used.

EXAMPLE: Ask students to make a list of all the places where they see ceramic tile being used in one day's time.

H. Tell students that answers to the following questions will help them select the proper materials and methods of installation. No job should start without favorable answers to these questions, resolved and agreed upon by all parties concerned.

1. Is the installation to be interior or exterior?

SUGGESTED ACTIVITIES

2. If interior, will it be in a wet or dry area, wall, floor, or ceiling?

3. If exterior, is there a potential danger of frost damage?

4. Is the tile selected suitable for this type of installation?

5. Is the backing suitable for this type of installation?

6. Are the selected installation materials and methods suitable for both the tile and backup surface?

7. Are the job conditions compatible with the installation specifications?

I. Invite a resource person to discuss with class the factors affecting tile selection and installation.

EXAMPLE: Contractor or distributor; architect or interior designer

J. Make a display of all the different types of tile that are outlined in units.

(NOTE: It is important for students to see the wide varieties of types, shapes, and glazes of ceramic tile that are available.)

K. Make a display of materials used in backings, setting ceramic tile, and grouting.

L. Show students special products that are available in the tile industry.

M. Give test after students complete unit and assignments.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Assignment sheets

1. Assignment Sheet #1 — Estimate Amount of Materials Needed for Tile Installations

2. Assignment Sheet #2 — Interpret a Work Order

3. Assignment Sheet #3 — Interpret ANSI Specifications and TCA *Handbook*

4. Assignment Sheet #4 — Interpret Labels from Tile Installation Products

E. Answers to assignment sheets

SUGGESTED ACTIVITIES

F. Test

G. Answers to test

III. Unit references

A. *American National Standard Specifications for Ceramic Tile A-137.1.* New York: ANSI, 1980.

B. *American National Standard Specifications for the Installation of Ceramic Tile A-108.* New York: ANSI, 1976.

C. *Ceramic Tile Manual.* Los Angeles, California: Building News, Inc., 1979.

D. *Ceramic Tile Shapes and Sizes.* Princeton, New Jersey: Tile Council of America, Inc., 1958.

E. *1982 Handbook for Ceramic Tile Installation.* Princeton, New Jersey: Tile Council of America, Inc., 1981.

F. "Recommended Specifications for the Application and Finishing of Gypsum Board GA-216-82." Evanston, Illinois: Gypsum Association, 1982.

G. *Tilesetting Workbook.* Sacramento, California: State Department of Education, 1975.

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Backing — Any material used as a base over which a finished material is to be installed

EXAMPLES: Gypsum board, water-resistant gypsum backing board, glass mesh mortar unit, solid masonry or gypsum wall

B. Bond coat — Material used to adhere ceramic tile to a prepared surface

C. Butter — To spread a bond coat on the back of a ceramic tile just before tile is placed

D. Cleavage membrane — Layer of fifteen-pound roofing felt or four-mil polyethylene sheeting used to isolate wire-reinforced mortar bed for tile from the concrete or wood subfloor

E. Cove — Trim tile having one edge with a concave radius; used to form a junction between the bottom wall course and floor, or to form an inside corner

F. Cove base (sanitary) — Trim tile having a concave radius on one edge and a convex radius landing on the opposite edge; often used as the only course of tile above the floor tile

G. Crazing — Cracking which occurs in fired glazes or other ceramic coatings due to critical tensile stresses in the glaze

H. Cushion-edge tile — Tile on which the facial edges have a distinct curvature that results in a slightly recessed joint

I. Dust-pressed — Process of forming a tile body by pressing into shape material of a low-moisture, almost dust-like consistency

J. Efflorescence — Residue deposited on the surface of a material by the crystallization of soluble salts

K. Elastomeric — Rubberlike

L. Extrusion process — Process used to form tile or trim units by forcing plastic clay mixtures through an opening of suitable configuration to shape a continuous ribbon of formed clay which is cut to appropriate lengths and widths

INFORMATION SHEET

M. Flush — Even or unbroken line or surface; being even or on the same line or plane

EXAMPLE: A door flush with the wall

N. Fused — Two or more materials melted together

O. Glass mesh mortar unit — Concrete glass fiber reinforced backing board

P. Glazed tile — Tile with a fused impervious facial finish composed of ceramic materials fused to the body of the tile which may be nonvitreous, semivitreous, vitreous, or impervious

Q. Grout — Modified portland cement or noncement based material used for filling tile joints

R. Gypsum board — Backing board consisting of a core of set gypsum surfaced with paper

S. Impervious tile — Tile with water absorption of 0.5 percent or less

T. Kraft paper — Strong paper made from sulfate processed wood pulp

U. Latex additive — Emulsion of organic, plastic resins or rubber compounds and water

V. Lug spacer — Protuberance on sides of tiles to provide space between tiles for grout lines

W. Matte glaze — Colorless or colored ceramic glaze having low gloss

X. Nonvitreous tile — Tile with water absorption of more than 7.0 percent

Y. No-slump mix — Consistency of cement mortar or grout mixture that will just hang on trowel; if combed, material should stand up and show notched trowel ridges

Z. Open time — Period of time in which bond coat is wet to the touch and will adhere to the tile

AA. Paver tile — Glazed or unglazed porcelain or natural clay tile formed by the dust-pressed method having six square inches or more of facial area

BB. Permeable — That which can be penetrated by liquid or vapor

CC. Potable — Fit to drink; drinkable

INFORMATION SHEET

DD. Sealant — Elastomeric material used to fill and seal joints; prevents passage of moisture and allows horizontal and lateral movement at joint

EE. Sealer — Substance used to coat installed tile to reduce permeability

FF. Semivitreous tile — Tile with water absorption of more than 3.0 percent, but not more than 7.0 percent

GG. Strike — To compact and smooth grout line with a striking tool

(NOTE: *Strike* may also be called *tool*.)

HH. Thin-set or thin-bed — Method of installing ceramic tile with bonding materials that can be applied to suitable substrates in a uniform coat ranging in thickness after beat in from 1/32" for organic adhesive to 1/8" for dry-set, latex-portland cement, or epoxy mortars

II. Unglazed tile — Hard, dense tile of uniform composition throughout; derives color and texture from materials of which the body is made

JJ. Vitreous tile — Tile with water absorption of more than 0.5 percent, but not more than 3.0 percent

II. Examples of places where ceramic tile can be used in residences

A. Floors, ceilings, walls

B. Counter tops

C. Patios

D. Fireplace facings and hearths

E. Heat shields and floor protectors for solid-fuel-burning stoves

III. Factors affecting tile selection and installation

A. Intended use of room or area

B. User's budget

C. Interior decorating trends

D. Available tile installation materials

E. Personal preference

INFORMATION SHEET

IV. Major types of ceramic tile

Type of Tile	Brief Description	Characteristics	Uses
Wall	Glazed tile with a body that is suitable for interior use and which is usually nonvitreous, and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions	Good surface hardness Easy to clean and maintain Fire resistant Chemically resistant to household acids	Interior walls and ceilings; light duty floors and counter tops
Mosaic	Tile formed by either dust-pressed or plastic method; usually 1/4" to 3/8" thick and having a facial area of less than six square inches; may be of either porcelain or natural clay composition, and may be either plain or with an abrasive mixture throughout	Nonstaining Excellent wearing qualities	Floors, walls, ceilings, and counter tops; interior or exterior
Quarry	Glazed or unglazed tile made by extrusion process from natural clay or shale; usually has six square inches or more of facial area	Excellent wear under hard service conditions	Floors, walls, ceilings, and counter tops; interior or exterior
Paver	Glazed or unglazed porcelain or natural clay tile formed by the dust-pressed method having six square inches or more of facial area	Excellent wear under hard service conditions	Floors, walls, ceilings, and counter tops; interior or exterior

INFORMATION SHEET

V. Types of glazes

A. Bright — High gloss glaze with or without color

B. Matte — Low gloss glaze with or without color

C. Crystalline — Extra heavy glaze produced for use on countertops and light-duty floor surfaces where abrasion or impact is not excessive

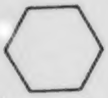
VI. Shapes of ceramic tile (Figures 1-6)

A. Square

FIGURE 1

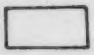
B. Hexagon

FIGURE 2



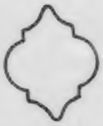
C. Rectangle

FIGURE 3



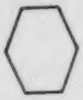
D. Valencia

FIGURE 4



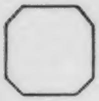
E. Elongated hexagon

FIGURE 5



F. Octagon

FIGURE 6



INFORMATION SHEET

VII. Types of trims and their ordering numbers (Figures 7-22)

A. Base (cove) — A-3401

EXAMPLE:

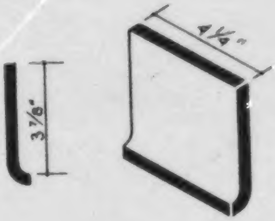


FIGURE 7

B. Base (cove) — A-1663

EXAMPLE:

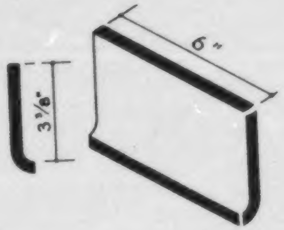


FIGURE 8

C. Base (sanitary cove) — S-3419

EXAMPLE:

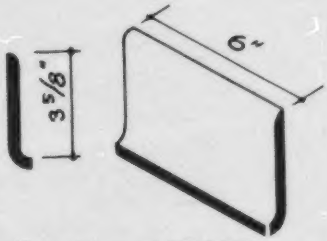


FIGURE 9

D. Base (out corner) — SCL- or SCR-3419

EXAMPLE:

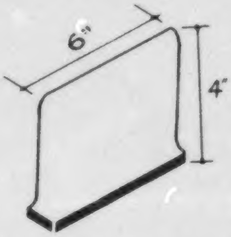


FIGURE 10

E. Base (out corner) — SCL- or SCR-3419-T

EXAMPLE:

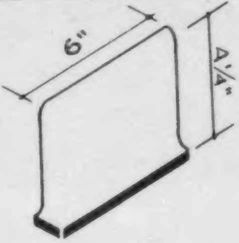


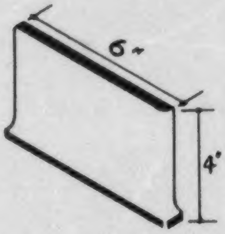
FIGURE 11

INFORMATION SHEET

F. Base (out corner) — SCL- or SCR-1663

EXAMPLE:

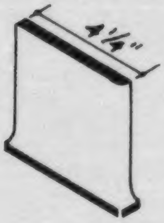
FIGURE 12



G. Base (out corner) — SCL- or SCR-3401

EXAMPLE:

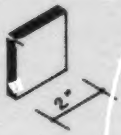
FIGURE 13



H. S-up angle (butterfly) — SM-4269

EXAMPLE:

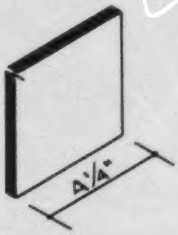
FIGURE 14



I. S-up angle (butterfly) — SM-4449

EXAMPLE:

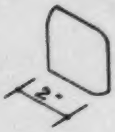
FIGURE 15



J. S-down angle — SN-4269

EXAMPLE:

FIGURE 16

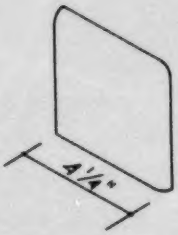


INFORMATION SHEET

K. S-down angle — SN-4449

EXAMPLE:

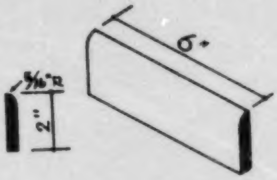
FIGURE 17



L. S-cap (surface bullnose) — S-4269

EXAMPLE:

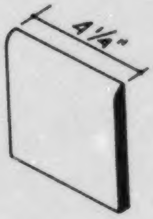
FIGURE 18



M. S-cap (surface bullnose) — S-4449

EXAMPLE:

FIGURE 19

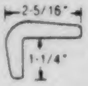


INFORMATION SHEET

N. Counter trim — S-8262

EXAMPLE:

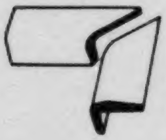
FIGURE 20



O. Square-in angle — SKL- or SKR-8262

EXAMPLE:

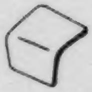
FIGURE 21



P. Out angle - SC-8262

EXAMPLE:

FIGURE 22



VIII. Types of trim and their uses

A. Cap — Used at the top and sides of the field to finish the installation

B. Base — Used to trim/join a tiled wall with a tiled floor

C. Down angle — Used at the top outside edge of the field to start the cap in a horizontal and/or vertical direction

D. Up angle — Used at the inside angle to start the cap in a horizontal and/or vertical direction

INFORMATION SHEET

E. Out angle — Trim piece used to change direction on salient angles

F. Square in angle — Connecting trim for reentrant angle

G. Counter trim — Trim for counter top edging

IX. Suitable prepared backings for thin-set installations in wet and dry areas

BACKING MATERIAL	DRY AREA				WET AREA		
	FLOORS	WALLS	CEILINGS	COUNTER TOPS	FLOORS	WALLS	CEILINGS
A. Gypsum board		✓	✓				
B. Portland cement mortar	✓	✓	✓	✓	✓	✓	✓
C. Gypsum plaster		✓	✓				
D. Concrete or concrete masonry	✓	✓	✓	✓	✓	✓	✓
E. Glass mesh mortar unit	✓	✓	✓	✓	✓	✓	✓
F. Brick	✓	✓			✓	✓	
G. Ceramic tile	✓	✓	✓	✓	✓	✓	✓
H. Marble	✓	✓	✓	✓	✓	✓	✓
I. Water-resistant gypsum board		✓				✓	
J. Exterior grade plywood	✓			✓			

INFORMATION SHEET

X. Descriptions of setting materials used in thin-set installation methods (Assignment Sheets #2 and #4)

(NOTE: Always use *sanded* dry-set or latex-portland cement mortars in preference to unsanded.)

Type	Description
Dry-set mortar	Mixture of portland cement with sand and additives imparting water retentivity; used as bond coat for setting tile
Latex-portland cement mortar	Mixture of portland cement, sand, and special latex additive; used as a bond coat for setting tile (NOTE: Because latexes vary considerably, the directions and recommendations of the manufacturer must be followed explicitly.)
Modified epoxy emulsion mortar	Mortar/grout system employing emulsified epoxy resins and hardeners with portland cement and silica sand
Epoxy mortar	Mortar system employing epoxy resin and epoxy hardener portions
Organic adhesive	Prepared organic material ready to use with no further addition of liquid or powder; cures or sets by evaporation (NOTE: Organic adhesive should NOT be used for exterior installation or to install tiles with deep button back patterns. Use modified epoxy emulsion mortar, latex-portland cement mortar, or epoxy mortar for installation of tiles with deep ribs or buttons.)
Epoxy adhesive	Adhesive system employing resin and epoxy hardener portions

INFORMATION SHEET

XI. Types of grouts and their descriptions

(NOTE: See Grout Specification Guide in current TCA *Handbook*.)

Type	Description
Commercial portland cement	Mixture of portland cement and other ingredients to produce a water-resistant, dense, uniformly colored material
Sand-portland cement	On-the-job mixture of one part portland cement to one part fine graded sand used for joints up to 1/8" wide; 1:2 for joints up to 1/2" wide; 1:3 for joints up over 1/2" wide — Up to 1/5 part lime may be added
Dry-set (dry wall)	Mixture of portland cement and additives providing water retentivity
Latex-portland cement	Mixture of dry-set, sand-portland cement, or commercial portland cement grout with special latex additive
Epoxy	Grout system employing resin and hardener portions, often containing coarse silica filler
Silicone rubber	An engineered elastomeric grout system for interior use employing a single component nonslumping silicone rubber, which upon curing is resistant to staining, moisture, mildew, cracking, crazing, and shrinkage

XII. Guidelines for mixing and using grout

A. Always follow manufacturer's directions precisely

(NOTE: Manufacturer's directions may or may not be complete.)

B. Keep a set of tools just for mixing, a bucket for grout mixture, and a five-gallon bucket for cleanup water

C. Use cool, potable water

D. Mix thoroughly to give a uniform consistency

E. Moisten nonvitreous tiles *before* grout is applied

F. Damp cure or use latex additive

INFORMATION SHEET

G. Always add grout to liquid, *not* liquid to grout

H. After thorough mixing, wait fifteen minutes before remixing

I. Fill joints solidly and remove excess grout from face of tile with good rubber trowel

J. Strike all joints to make them dense, smooth, and hard

XIII. Characteristics of good grouting

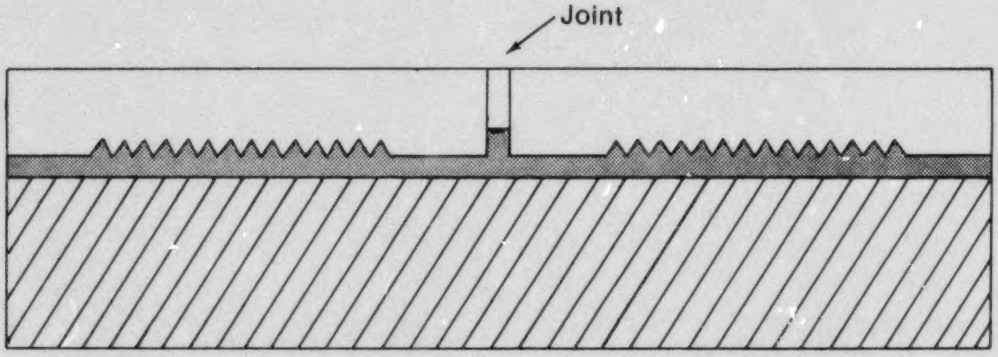
A. Cured hard, smooth, and uniform

B. Strong and compact to meet normal wear conditions

C. Finished flush to top of square-edged tile (Figure 23)

EXAMPLE:

FIGURE 23

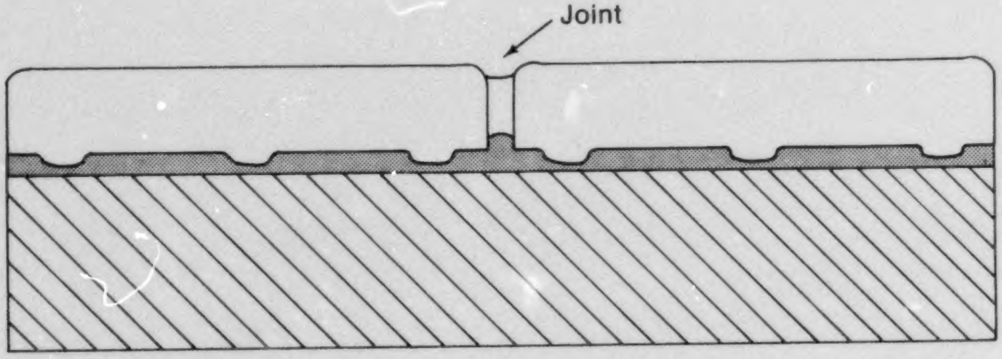


INFORMATION SHEET

D. Tooled or struck to depth of cushion on cushion-edged tile (Figure 24)

EXAMPLE:

FIGURE 24



E. Absence of all grout from face of tile when job is finished

XIV. Reasons for grout discoloration

- A. Applying grout before organic adhesive has time to cure properly
- B. Using too much liquid to mix colored grout
- C. Allowing grout to dry too quickly
- D. Applying different depths of grout in the joints
- E. Using too much water on freshly grouted areas
- F. Acid-cleaning
- G. Efflorescence
- H. Excessive glaze on edge of tile
- I. Inadequate mixing
- J. Use of two different batch lots
- K. Failure to remove plastic spacers

INFORMATION SHEET

L. Contamination from dirty tools or materials

XV. Ways to prevent grout discoloration

A. Follow manufacturer's directions

B. Damp cure or cover grout with kraft paper for seventy-two hours to slow down drying time and to allow grout to dry or cure at an even rate

(NOTE: If latex additive is used, damp curing is not needed.)

C. Mix grout with as little liquid as possible for proper application

(NOTE: If more than one mix is needed, make each the same in liquid content. Never stop a grout job in the middle of the field or in any conspicuous place.)

D. Keep excess water off grouted areas

(CAUTION: Never use a wet sponge for cleanup.)

E. Keep setting bed materials out of grout joints

F. Clean only with appropriate cleaners recommended for ceramic tile

XVI. Special products used in tile installations

A. Mounted tile — Tile assembled into units or sheets to facilitate handling and installation

B. Pregrouted ceramic tile sheets — Individual ceramic tiles, factory assembled into pregrouted sheets of various sizes; used for various wall installations

C. Special purpose tile — Glazed or unglazed tile having specified physical design or appearance

D. Glass mesh mortar unit — Backing and underlayment designed for use with ceramic tile in wet or dry areas

E. Threshold — Transitional piece between two different finished floor levels

XVII. Abbreviations needed while using TCA *Handbook* and ANSI specifications

A. ANSI — American National Standards Institute

B. TCA — Tile Council of America

C. ASTM — American Society for Testing and Materials

INFORMATION SHEET

D. o.c. — On center

XVIII. Steps in material estimating (Assignment Sheets #1 and #3)

A. Check backings for suitability

(NOTE: Review seven basic questions.)

B. Check the specifications

EXAMPLES: Type and size of area to be tiled
Type of base
Size of tile
Inserts
Type of trim
Accessories
Special materials
Special preparation required

C. Check room schedule on the blueprint

EXAMPLES: Rooms that have tile
Height of wainscot
Trims in the rooms (trims around openings, if any)
Type of threshold

XIX. Estimating amount of material needed in tile installations (Assignment Sheet #1)

A. Find surface area of field to be tiled

(NOTE: Tile is ordered by the square foot.)

1. Determine surface area of a floor in square feet by multiplying length in feet times width in feet

EXAMPLE: Floor length = 16'0"
Floor width = 15'0"
Floor area = 15'0" x 16'0" = 240 sq ft

2. Determine surface area of a wall in square feet by multiplying length in feet times height in feet; subtract from the total the areas of all openings

EXAMPLE: Wall length = 56' 0"
Wall height = 8' 6"
Door = 7'3" x 3'0"
Wall area = 56'0" x 8'6"= 476 sq ft
Door = 21 sq ft
Total area = 476 − 21 = 455 sq ft

INFORMATION SHEET

3. Determine surface area of a ceiling in square feet by multiplying length in feet times width in feet

   EXAMPLE: Ceiling length = 20′0″
   Ceiling width = 15′0″
   Ceiling area = 15′0″ × 20′0″ = 300 sq ft

B. Determine quantity of trim units (cap and base)

(NOTE: Trim is ordered by the piece.)

1. Measure distance to be trimmed
2. Subtract widths of all openings from this figure
3. Divide length of one trim unit into total lineal inches and round to nearest whole number

   EXAMPLE: Total distance to be trimmed = 12′0″
   Total opening widths = 4′0″
   Lineal distance to be trimmed = 8′0″ or 96″
   Length of trim unit = 6″
   Trim units needed = 96 ÷ 6 = 16 units

C. Determine quantity of additional materials required

EXAMPLES: Mortar, grout

(NOTE: Coverage will vary due to a number of factors. Estimates on manufacturer's labels may not accurate for your particular situation and methods.)

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ASSIGNMENT SHEET #1 — ESTIMATE AMOUNT OF MATERIALS NEEDED FOR TILE INSTALLATION

NAME ____ SCORE ________________

Before a tile setter can begin a job, the correct quantity of material must be available in the work area. To avoid purchasing too much or too little tile, the tile contractor must estimate the quantity needed. To have too much material on hand is expensive: Storage space must be found or necessary transportation paid. To have too little material on hand slows down the work and may require a layoff by the contractor. Also, if more tiles must be ordered, the shade may vary even though the manufacturer's shade numbers are the same.

An employer may choose a tile setter to estimate the amount of material needed to complete a tile job. The tile setter who can estimate needed materials has a better chance of advancing.

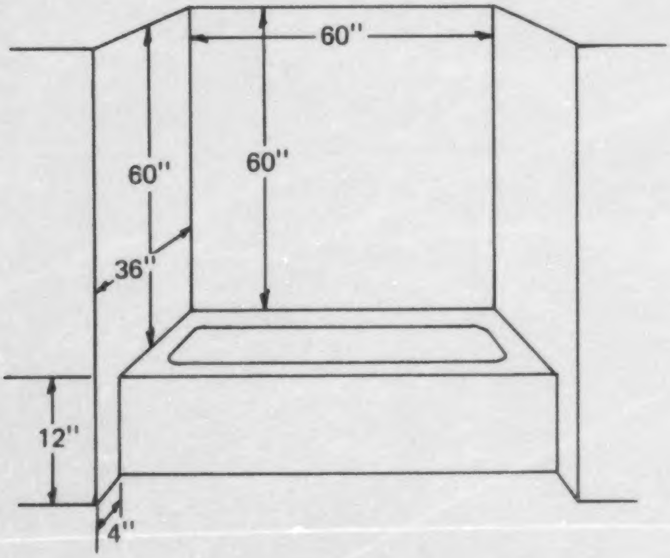
Estimate the tile and trim needed for the following installations. Round all tile estimate figures to the next whole number as you cannot order part of a tile. Also remember that your answers are estimates, approximations, and that an extra amount of tile is ordered to compensate for small errors in calculation and tiles broken on the job.

ASSIGNMENT SHEET #1

A. Tub surround (Figure 25)

1. Wall area = ____________________ square feet
2. Trim length = ____________________ lineal feet
3. Quantity of 6" trim (S-cap) = ____________________trim pieces
4. Quantity of 2" × 2" down angles = ____________________ down angles
5. Quantity of 4 1/4" × 4 1/4" tile = ____________________ square feet of tile

FIGURE 25

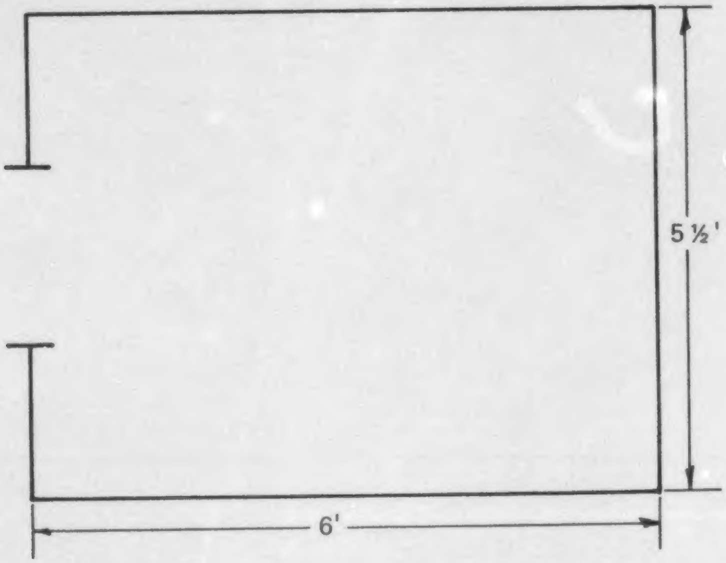


ASSIGNMENT SHEET #1

B. Foyer floor (Figure 26)

1. Floor area = ______________________ square feet
2. Quantity of 4" × 8" quarry tiles = ______________________ square feet of tile

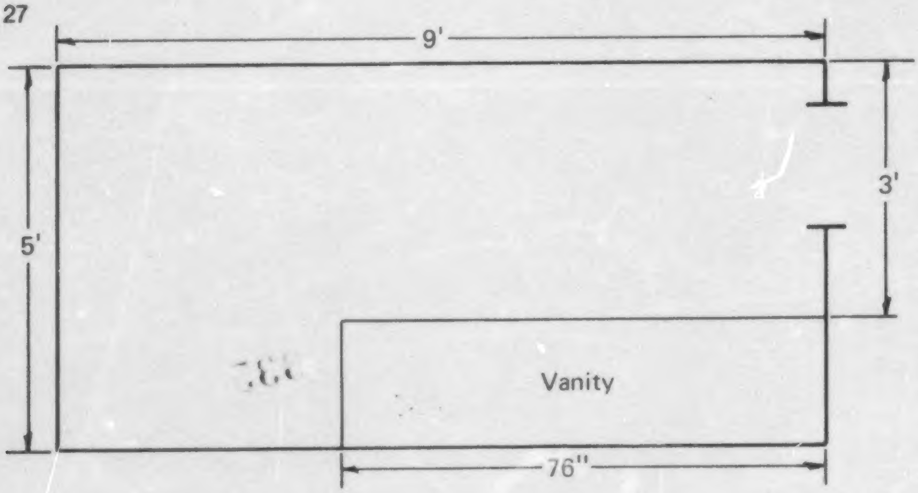
FIGURE 26



C. Bathroom floor (Figure 27)

1. Floor area = ______________________ square feet
2. Quantity of 4 ¼" × 4 ¼" tiles = ______________________ square feet of tile

FIGURE 27

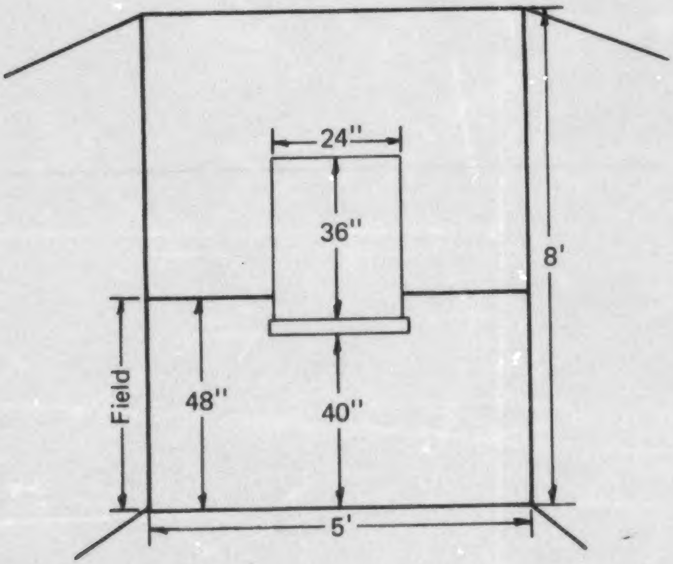


ASSIGNMENT SHEET #1

D. Window wall in bathroom (Figure 28)

1. Wall area (field only) = ____________________ square feet
2. Trim length = ____________________ lineal feet
3. Quantity of 4 ¼" × 4 ¼" tiles = ____________________ square feet of tile
4. Quantity of 6" trim (S-cap) = ____________________ trim pieces

FIGURE 28

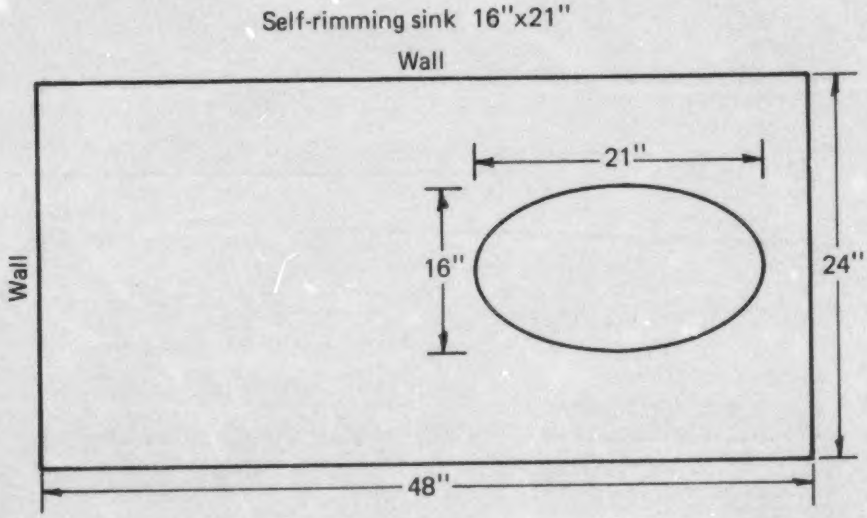


ASSIGNMENT SHEET #1

E. Bathroom counter top (Figure 29)

1. Counter top area = ______________________ square feet
2. Trim length = ______________________ lineal feet
3. Quantity of 4 1/4" × 4 1/4" tile = ______________________ square feet of tile
4. Quantity of trim (front edge 6" × 2" × 1 1/4") = ______________________ trim pieces
5. Quantity of 2" × 2" outside angles = ______________________ outside angles

FIGURE 29


Self-rimming sink 16"x21"
Wall
Wall
21"
16"
24"
48"

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ASSIGNMENT SHEET #2 — INTERPRET A WORK ORDER

NAME ______________________________ SCORE ____________

Following a work order is one key to success for a tile setter. If your employer and customer are to be satisfied, you must learn to read and follow the directions on a work order. Use the sample work order on the following page to answer the questions below.

A. What is the customer's name and address? ______________________________

____

____

B. When is the tile to be installed? ______________________________

____

C. What remarks does the work order list? ______________________________

____

D. What rooms or areas of the house are to receive tile? ______________________________

____

E. How many square feet are to be installed in shower stall off master bedroom? ______

____

F. What type of grout will be used in the bath off the hall? ______________________________

____

G. What room(s) adjoin the entryway? ______________________________

____

H. What additive(s) will be used in the grout? ______________________________

____

I. What grouts will be used in the tile installations? ______________________________

____

ASSIGNMENT SHEET #2

J. What kind of tile will be installed in the bath off the hall? ______________________

K. What does tile setter do with leftover tile? ______________________

L. What size grout joints are to be used? ______________________

CT - 33-B

ASSIGNMENT SHEET #2

SHORT'S *Carpet and Tile*

104 E. 6th 372-6116
STILLWATER, OKLAHOMA 74074

CUSTOMER Joyce Sawatzky DATE March 3
ADDRESS 1423 W. 4th PHONE 555-3720

WORK ORDER

INSTALLER Taylor PURCHASE ORDER NO. TCA-6321
INSTALLATION DATE March 21 REMARKS Phone First

JOBS TO BE DONE:

I. Install ceramic tile over water-resistant gypsum board around tub in bath off hall.

Tile — Tuscany 4 1/4" x 4 1/4" No. 905 TY Gold — by American Olean. 55 sq ft plus trim. Lay tile at least cap higher than shower head. Install 1 white china soap and rail and 1 24" white china towel bar on wall opposite shower head. Use H. B. Fuller 122 Double Duty Adhesive. Use white dry wall grout with Laticrete 3701 Grout Additive.

II. Install shower stall off master bedroom.

Tile — Potters Touch No. 5501 White 4 1/4" x 4 1/4" by Florida Tile. 100 sq ft plus trim. Tile walls, ceilings, curb, and door jams. Install 1 soap and rail white china. Install shower door hinged right swing out. Use Wonderboard for backing, and install tile. Use white dry-set mortar. Use white dry wall grout with 3701 Grout Additive. Lay 1" white shower floor on mortar bed and grout with grey dry wall grout with Laticrete 3701 Grout Additive.

III. Install entry tile

Tile — Ultrapaver 812 Pecan by American Olean — 5" Hexagon. 58 sq ft Entry — 6 ft x 9 ft; 54 sq ft. Use grey dry-set mortar and brown floor grout with Laticrete 3701 Grout Additive. Install floor with 3/8 " joints. No bullnose trim needed as adjoining rooms are carpeted. Stop tile under center of opening to living rm and under center of closed door to family rm.

IV. Leave several pieces of each tile on the job for the customer in case future repairs are needed.

V. Turn in Work Order when job is finished.

(THANKS)

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ASSIGNMENT SHEET #3 — INTERPRET ANSI SPECIFICATIONS AND TCA *HANDBOOK*

NAME ____ SCORE ________________

A tile setter may occasionally be faced with interpreting specifications set forth by the American National Standards Institute and the Tile Council of America. Although reading the specifications can be confusing, it is not really a difficult task.

Using the *American National Standard Specifications for the Installation of Ceramic Tile* (A-108, A-118) and the *Handbook for Ceramic Tile Installation*, answer the following questions.

PART I — ANSI specifications

A. What is the minimum time that dry-set mortar should cure before grouting? ________

B. What is the minimum time that organic adhesive should cure before grouting? _____

C. How long should floors be protected from traffic? ____________________________

D. When setting ceramic tile in organic adhesive on walls, what is the required average contact area between the tile backs and the adhesive? ____________________

____

E. If the tiles are to be set on the walls of a shower stall or bathtub surround with organic adhesive, does the required average contact area remain the same? ______________

____

If not, what should it be? ____

____

ASSIGNMENT SHEET #3

F. What materials are suitable backings for organic adhesive installations? ______________

G. Is the tile installer responsible for inspection of the surfaces to be tiled prior to starting work? ______________

H. Can ceramic tile be installed with epoxy over plywood underlayment without gaps between sheets? ______________

I. What are the allowable variations in plane of finished tile work? ______________

PART II — *Handbook* guidelines

A. Is the *Handbook* a specifications for tilework? ______________

B. What is the performance level rating the following floor installations?

1. Organic adhesive on wood or concrete — ______________
2. Epoxy adhesive on existing resilient tile — ______________
3. Ceramic mosaic set in epoxy mortar or wood — ______________
4. Quarry tile set in epoxy mortar on wood — ______________
5. Ceramic mosaic set in dry-set mortar on concrete — ______________

ASSIGNMENT SHEET #3

C. Identify the areas for which the following wall installation methods are suitable.

1. Organic adhesive over gypsum board — ______________________________

   ____

2. Dry-set mortar over glass mesh mortar units — ______________________

   ____

3. Dry-set mortar over masonry — ______________________________

   ____

4. Organic adhesive over water-resistant gypsum board — ______________

   ____

5. Latex-portland cement mortar over water-resistant gypsum board —________

   ____

D. What *Handbook* method number, or numbers, would you refer to when installing a sound-rated floor over a wood substructure? ____________________

____

____

E. What is the size requirement of the gap between plywood sheets when the floor tile will be installed with organic adhesive? ____________________

F. What is the fire resistant rating of the fire-rated wall installation method?__________

____

G. When installing ceramic tile counter tops, why is it necessary to check the distance between the bottom edge of the trim piece and the finish floor surface? __________

____

____

H. How are grouts rated for performance? ____________________________

____

ASSIGNMENT SHEET #3

I. Can tile be set by any of the thin-set methods directly on a waterproof membrane? ____

If so, with which methods? ______________________________________

____

____

J. What are the only recommended thin-set materials for installing tile over glass mesh mortar units on floors? ______________________________________

____

____

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ASSIGNMENT SHEET #4 — INTERPRET LABELS FROM TILE INSTALLATION PRODUCTS

NAME ______________________________ SCORE ____________

Reading labels and following their directions are important tasks that a tile setter does. Many mistakes can be avoided by following directions carefully.

PART I

Using the sample label on the next page to answer the following questions.

A. What product is the label for? ______________________________

B. With what do you mix the grout powder? ______________________________

C. How long should the mixture sit before remixing? ______________________________

D. How much grout should be mixed? ______________________________

E. In what condition should joints be before grout is applied? ______________________________

F. Should joints be dampened? ______________________________

G. How should this grout be applied? ______________________________

H. How should this grout be allowed to cure? ______________________________

I. What cautions does the label contain? ______________________________

ASSIGNMENT SHEET #4

DRY WALL GROUT

25 LBS. (11.3 Kilograms)

DIRECTIONS

Mix to a thick consistency with clean water suitable for drinking. Be sure container and mixing equipment are clean. after thorough mixing, wait fifteen minutes, then remix and use. Do not mix more than can be used in about thirty minutes.

Joints should be thoroughly cleaned before applying grout. It is not necessary to dampen joints. Apply grout with a trowel or squeegee, then remove excess material. Wait a few minutes for grout to become slightly firm, then use a clean, damp sponge to dress the joint. Damp cure under extremely dry conditions. After joint is firm, polish with a soft, clean, white cloth.

This mixture is complete except for the addition of water. Before grouting organic adhesive installations, allow adequate time for solvents in the adhesive to evaporate.

CAUTION

YOUR SKIN MAY BE SENSITIVE TO CEMENT. WEARING RUBBER GLOVES IS SUGGESTED. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN. IN CASE OF CONTACT, FLUSH THOROUGHLY WITH WATER. FOR EYES, GET PROMPT MEDICAL ATTENTION.

KEEP OUT OF REACH OF CHILDREN

Made according to one or more of the following U.S. Patents: Nos. 2,838,411; 2,934,932; 2,959,489; 2,962,467; 2,990,382; 3,030,258; 3,243,307; 3,486,960.

ASSIGNMENT SHEET #4

PART II

Use the sample on the next page to answer the following questions.

A. What product is the label for? ______________________

B. How much material is contained in this package? ______________________

C. What must be done to porous quarry tile before grouting? ______________________

____

D. How should this product be mixed? ______________________

____

____

____

____

E. What must be done after you have removed excess material from surfaces of tiles?

____

____

F. How long should floors be protected from general traffic and use? ______________________

____

G. What steps must be performed after tile has been protected for the specified period of time? ______________________

____

____

____

____

H. What company disclaimer appears with this product? ______________________

____

____

____

ASSIGNMENT SHEET #4

QUARRY GRADE

50 LBS. (22.7 KILOGRAMS)

---

1 — Seal or wax porous quarry tile before grouting.

2 — Mix with clean water in a clean container. Add grout to the water slowly and mix thoroughly until a smooth, thick mixture is obtained. Let stand for 15 minutes then remix before using. Do not add more water or dry powder after material has been mixed.

3 — Fill joints until flush with the surface making certain no voids remain.

4 — Remove excess material from surface of tile.

5 — Dust dry DENSE GROUT on the joint and rub in a circular motion with a burlap pad until joints are smooth and flush with the tile.

6 — Damp cure under extremely dry conditions.

7 — Floors should be protected from general traffic and use for at least 72 hours after grouting.

8 — After 72 hours damp mop the joints. Then clean the excess grout film from the tile surface with a tile cleaner. Follow manufacturer's directions CLOSELY.

9 — Flush surface immediately with enough water to remove the tile cleaner.

10 — Bonsal expressly disclaims any and all warranties and guarantees of any sort as to color and appearance of product, at all times, at and after opening of the container.

CAUTION

YOUR SKIN MAY BE SENSITIVE TO CEMENT. WEARING RUBBER GLOVES IS SUGGESTED. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN. IN CASE OF CONTACT, FLUSH THOROUGHLY WITH WATER, FOR EYES, GET PROMPT MEDICAL ATTENTION.

KEEP OUT OF REACH OF CHILDREN

BONSAL IS A REGISTERED TRADE MARK OF THE W.R. BONSAL COMPANY

LILESVILLE, N.C.

ASSIGNMENT SHEET #4

PART III

Using the sample label on the following page to answer the following questions.

A. What product is the label for? ______________________________

B. With what specifications must all installations conform? ______________

____

C. How should the surface to be tiled be prepared, and what conditions should it meet?

____

____

____

____

D. How should the skim and second coat be applied? ____________________

____

____

E. How thick should the setting bed be after beating in? __________________

____

F. What installations must have 100 percent contact between tile and mortar? ______

____

____

G. On what surfaces may this product be used? ____________________

____

____

____

____

ASSIGNMENT SHEET #4

H. On what surfaces should this product *not* be used? ______________________

____

____

I. Should tile be presoaked? ______________________

J. How much material is contained in this package? ______________________

What is its coverage? ______________________

ASSIGNMENT SHEET #4

SANDED THIN-SET MORTAR FOR NON-POROUS TILE

50 LBS. (22.7 KILOGRAMS)

DIRECTIONS

All installations must conform to ANSI-A-108.5.

Remove any dirt or other foreign material from the surface on which tile is to be installed. The surface should be structurally sound and dimensionally stable. It should also be frost-free and remain above 40°F. for 72 hours.

Always use clean water, clean containers and tools. Mix the dry powder thoroughly with enough water to produce a thick but trowelable consistency. Let stand for 15 minutes then remix before using. Do not add more water or dry material.

With pressure, apply a skim coat on the surface. Immediately follow with a heavier coat of about 3/16 ". Comb this bed with a notched trowel. It is helpful to run a small test panel to determine setting time which changes with temperature, relative humidity, absorption, etc. for best results, cover a small area with this mix, then cover this with tile and immediately beat-in the tile. After beating the tile, the setting bed should have a maximum thickness of 1/8 inch. Exterior installations, floors and showers shall have 100 percent contact between tile and mortar. Once initial set has taken place the tile should not be disturbed for 24 hours. Damp cure for 72 hours.

This mix can be used for setting tile on Concrete Masonry, Brick, Poured Concrete, Portland Cement Plaster, Foam Glass, Gypsum Wallboard, Old Tiled Surfaces, Marble, Gypsum Plaster Browncoat, Gypsum Black and Expanded Polystyrene.

DO NOT USE THIS MIX OVER PLYWOOD, MASONITE, GYPSUM PLASTER WHITE COAT, CELLULOSE WALLBOARD OR PAINTED SURFACES.

Do not presoak the tile.

For installation of cement-bodied tile consult the tile manufacturer.

COVERAGE:

Approximately 100 sq. feet.

CAUTION

YOUR SKIN MAY BE SENSITIVE TO CEMENT. WEARING RUBBER GLOVES IS SUGGESTED. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN. IN CASE OF CONTACT, FLUSH THOROUGHLY WITH WATER; FOR EYES, GET PROMPT MEDICAL ATTENTION.

KEEP OUT OF REACH OF CHILDREN

ASSIGNMENT SHEET #4

PART IV

Using the sample label on the next page to answer the following questions.

A. What product is the label for? ____________________

B. Name three interior substrates over which this product may be used. ____________________

C. Over what surfaces should this product *not* be used? ____________________

D. With what setting materials should this product *not* be used? ____________________

E. Why is it recommended that installations performed in high temperatures or windy conditions may require a protective covering? ____________________

F. What is the approximate coverage for flat-backed tile using a 1/4" × 1/4" × 1/4" trowel?

G. What is the dilution ratio for use with latex-portland cement or dry-set mortar installations? ____________________

H. What caution does this label contain? ____________________

I. When mixing mortars and grouts, why must excessive high speed mixing be avoided?

ASSIGNMENT SHEET #4

HB FULLER®

acrylic latex additive

865

Acrylbond

A concentrated acrylic admixture for improving the performance of factory prepared dry-set mortars and grouts. For installing slate, marble precast terrazzo and all types of ceramic tiles.

SUBSTRATES: Interior—Over the following clean, dry and sound surfaces: masonry, concrete, brick, Wonderboard®, gypsum board (dry areas only), sanded ceramic tile or marble and exterior grade plywood. Interior installations over plywood requires a double wood floor. Follow Tile Council of America Handbook Detail F143.

Exterior—Concrete, masonry and cured mortar beds.

LIMITATIONS: Do not use with contractor prepared portland cement and sand thin-set mortars. Not recommended for installations over rubber, synthetic resilient flooring, painted or sealed surfaces. Do not apply below 40°F because curing is delayed. The higher the temperature the shorter the working time. Exterior installations performed in high temperature or windy conditions may require a protective covering to reduce the possibility of incomplete curing.

TROWEL RECOMMENDATIONS	APPROX. COVERAGE
Ceramic Mosaics—3/32" V-notch trowel	120 - 145 sq. ft
Quarry, pavers, and flat backed ceramic tiles—¼" x ¼" x ¼"	75 - 90 sq. ft
Modular tile with high lugs or ribs—¼" x ⅜" x ¼"	50 - 60 sq. ft

DIRECTIONS:

1. Surfaces to be tiled should be clean, dry, level and free from foreign materials. Surface protrusions should be removed by sanding, scraping or chipping. Plywood should be sanded over and vacuumed to remove dust.
2. Mixing—Dilute Acrylbond with water by volume in the ratios listed below for the following specific uses:

JOB REQUIREMENT	RECOMMENDED DRY MIX	RECOMMENDED AMOUNT DILUTED TA-865
Interior floors ⅝" plywood overlay required	50 lbs.—TA-302 or 303 Dry-Set Mortar or any TCA Formula #750	Approx. 2 gallons Dilution ratio: 1 gal. TA-865 1 gal. water
All installations specified for latex portland cement or dry-set mortars	50 lbs. TA-300, 301, 302, or 303 Dry Set Mortar or any TCA Formulas #750 or #763	1½ gallons or up to 1¾ gallons Dilution ratio: ½ gal. TA-865 1 gal. water
Conventional Portland Cement Mortar Thick Bed (Floors only)	Normally 3:1 ratio of sand/portland cement	Gauge to proper working consistency Dilution ratio: ½ gal. TA-865 1 gal. water
Grouting	Any factory prepared portland cement grout	Gauge to proper working consistency Dilution ratio: ½ gal. TA-865 1 gal. water

- Can be tailored to many job requirements
- Reduces installation costs by saving freight on water
- Interior/Exterior use on Floors and Walls
- Excellent Overall Strength
- Recommended for Wet Areas
- Eliminates Damp Curing
- Enhances and Improves Color Retention of Grouts
- Meets or Exceeds Bond Strength and Water Resistance Requirements of ANSI A118.4, A118.1, A136.1 and CTI-64

NET CONTENTS

CAUTION!
If ingested may cause slight discomfort.
KEEP OUT OF REACH OF CHILDREN

Thoroughly mix all mortars or grouts, allow to stand or slake for 10 - 15 minutes then remix prior to use. Avoid excessive high speed mixing, not to exceed 300 RPM, to prevent air being induced into the mortar, which reduces its strength.

3. Apply mortar using the flat side of the trowel following up with the notched side, being sure mortar application is thick enough to allow 100% contact between adhesive and tile.
4. Trowel an area no larger than can be covered within 30 minutes. Press or beat tile into setting bed to promote a good bond.
5. Grouting can be accomplished while mortar is still plastic (not set) or 72 hours after installation. No traffic should be allowed on floor prior to grouting.
6. Clean excess mortar from the face of tile immediately as cured material is difficult to remove.

Please refer to the product data sheet for further details.
Wonderboard® is a registered trademark of Modulars, Inc.

ROTATE YOUR STOCK

NOTICE: Our only obligation shall be to replace or pay for any material proved defective. Beyond the purchase price of materials supplied by us, we assume no liability for damages of any kind and the user accepts the product "as is" and without warranties, express or implied. The suitability of the product for an intended use shall be solely up to the user.

H.B. Fuller Company
Construction and
Consumer Products Division

315 South Hicks Road
Palatine, Illinois 60067

Form #8650709R0881

TA-865

ASSIGNMENT SHEET #4

PART V

Use the product label on the next page to answer the following questions.

A. What product is this label for? ______

B. For what type tile is this product recommended? ______

C. May this product be used for exterior installations? ______

D. For what type floor installations is this product recommended? ______

E. Over what wall substrates may this product be used? ______

F. Over what substrates should this product *not* be used? ______

G. What additional limitations are listed for this product? ______

H. What is the coverage of the material contained in this package? ______

I. What ANSI requirements does this product meet? ______

ASSIGNMENT SHEET #4

H.B. Fuller®
ceramic tile adhesive-walls & floors

USES: Recommended for the interior installation of slate and all ceramic tiles Installations of "lug" or button backed tiles are limited to wall applications only.

SUBSTRATES: Floors — DOUBLE DUTY adhesive is recommended for residential installations over exterior or marine grade plywood; glass mesh mortar units (Wonderboard*); well cured, dry, dimensionally stable concrete on, above or below grade; and cured plaster. Surfaces such as tempered masonite (rough side), cement asbestos board, particle board, and synthetic flooring (linoleum, asphalt and vinyl asbestos tile) are not ideal backings for ceramic tile, according to Tile Council of America (T.C.A.) Handbook.

Walls — For installations over glass mesh mortar units (Wonderboard*); gypsum wall board (for dry areas); water resistant gypsum wallboard (for wet areas); cured white or brown gypsum plaster; cured portland cement plaster, and well cured, dry, dimensionally stable concrete.

Countertops — Recommended on countertops where a thin bed method is desired. Follow T.C.A. Installation Detail C612-82. For installations over plastic laminates, follow T.C.A. Installation Detail TR911-82.

Renovation —For tile over tile applications, follow T.C.A. Installation Detail TR912-82 or TR913-82.

LIMITATIONS: Do not use for setting fixtures or marble. Do not use for underwater applications or where hydrostatic pressure exists. Exterior or marine grade plywood surfaces should be limited to dry interior floor applications only. When used with large flat backed tiles or when bonding tiles to non-breathing back-ups, the set-up time will be extended.

COVERAGE: 40-60 sq. ft. per gallon when a $\frac{3}{32}$" V-notch trowel is used for setting standard wall tile, ceramic and mosaic floor tile. 20-30 sq. ft. per gallon when a $\frac{1}{4}$" x $\frac{3}{8}$" x $\frac{1}{4}$" square notch trowel is used for wall installations of modular tiles or tiles with lugs or ribs.

DIRECTIONS:

1. The substrate should be structurally sound, clean, dry, and plumb. Remove all grease, sealers, dirt, wallpaper, etc. Score all painted surfaces, loose or "squeaky" floor boards should be glued, nailed or screwed down tight. Cover a springy floor with $\frac{5}{8}$" thick exterior grade plywood.

2. For best results, all tiling materials, room and adhesive should be at 50° F for 24 hours before and 48 hours after installation.

3. Plan the job to minimize the amount of wasted tile and the number of cuts.

4. Apply adhesive to the substrate with pressure using the flat side of the trowel to promote a good mechanical bond. Then, comb the surface using the proper notched trowel to attain an even setting bed. Press or twist individual tile or sheets of tile into adhesive, using care to maintain accurate joint alignment and spacing. Tiles may be set on walls from top or bottom since there is no slippage.

5. Beat-in tiles with a rubber-faced beating block to promote 100% coverage of tiles with adhesive, avoiding air pockets under the tile. Proper installation requires a minimum of $\frac{1}{32}$" continuous layer of mastic between the tile and substrate, after beat-in.

** Wonderboard is a registered trademark of Modulars, Inc.*

122
double duty™

Multi-purpose non-flammable adhesive designed for the interior installation of ceramic tile on walls and floors.

- Multi-purpose
- Non-flammable
- Strong Resilient Bonds
- Freeze Thaw Stable
- Quick Grab—No Slippage
- Excellent Water Resistance
- Easy Troweling
- Meets or Exceeds the Requirements of ANSI A136.1 Type I and II

NET CONTENTS

CAUTION!
CONTAINS PETROLEUM DISTILLATE
If ingested may cause slight discomfort. Call a physician immediately. Close container after each use.
KEEP OUT OF REACH OF CHILDREN.

6. Apply tiles within 35-45 minutes after spreading adhesive. We suggest that tile cuts or trim work be completed prior to spreading adhesive. Do not set tiles after a skin has formed on the adhesive, scrape off dried material and apply fresh adhesive.

7. Remove fresh adhesive from face of tile with warm soapy, water. Dried adhesive must be removed with mineral spirits.

8. Tile may be grouted as soon as adhesive is set and tiles are held firmly in place. We recommend the use of H. B. Fuller® wall and floor grouts for all ceramic tile installations.

ROTATE YOUR STOCK

NOTICE:
Our only obligation shall be to replace or pay for any material proved defective. Beyond the purchase price of materials supplied by us, we assume no liability for damages of any kind and the user accepts the product "as is" and without warranties, express or implied. The suitability of the product for an intended use shall be solely up to the user.

H.B. Fuller Company
Construction and
Consumer Products Division

315 South Hicks Road
Palatine, Illinois 60067

Form No. 1220406R0382

TA-122

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A. 1. 55 sq ft
   2. 23 lineal ft
   3. 46 trim pieces
   4. 2 down angles
   5. 55 sq ft of tile

B. 1. 33 sq ft
   2. 33 sq ft of tile

C. 1. 33 sq ft
   2. 33 sq ft of tile

D. 1. 19 sq ft
   2. 3 lineal ft
   3. 19 sq ft of tile
   4. 6 trim pieces

E. 1. 8 sq ft
   2. 6 lineal ft
   3. 8 sq ft of tile
   4. 12 trim pieces (front edge)
   5. 1 outside angle

Assignment Sheet #2

A. Joyce Sawatzky, 1423 West 4th

B. March 21

ANSWERS TO ASSIGNMENT SHEETS

C. Confirm starting time with customer

D. Bath off hall, shower stall off master bedroom, entry

E. 100

F. White dry wall grout

G. Living room, family room

H. Laticrete 3701 Grout Additive

I. White dry wall grout, grey dry wall grout

J. Tuscany 4 1/4" × 4 1/4" No.-905 TY Gold — by American Olean

K. Leave several pieces of each tile on the job for the customer in case future repairs are needed

L. 3/8"

Assignment Sheet #3

(NOTE: These answers are taken from ANSI A-108-1976 and 1983 TCA *Handbook.* Use of other editions may give answers different from those given.)

PART I

A. 48 hours [A-108.5, page 18, paragraph A-4.3.4.1]

B. 24 hours [A-108.4, page 16, paragraph A-4.2.3.2]

C. At least 72 hours [General Requirements, page 9, paragraph A-1.5.2.1]

D. 75% or more [A-108.4, page 16, paragraph A-4.2.1.4.2]

E. No; it shall be 95% [A-108.4, page 16, paragraph A-4.2.1.4.2]

F. Gypsum board, water-resistant gypsum backing board (wet areas) gypsum plaster, exterior grade plywood, cement asbestos board [Foreword, page 3, paragraph AN-2.5.3.2]

G. Yes [General Requirements, page 10, paragraph A-3.1]

H. No [General Requirements, page 11, paragraph A-3.1.4.3.3]

I. No variations exceeding 1/8 inch in 8 feet [Workmanship, page 11, paragraph A-3.3.10]

ANSWERS TO ASSIGNMENT SHEETS

PART II

A. No [page 3, left column]

(NOTE: Students must locate methods in *Handbook* and select suitable areas from chart on pages 8 and 9.)

B.
1. Residential [pages 8 and 9, F116,F142]
2. Residential [pages 8 and 9, TR711]
3. Residential if grouted with portland cement and sand; light if grouted with epoxy [page 8 and 9, F143]
4. Extra heavy [pages 8 and 9, F143]
5. Heavy if grouted with portland cement/sand and wet cured; moderate if grouted with latex-portland cement on A-118.3 epoxy [pages 8 and 9, F113]

(NOTE: To answer the following questions, student must locate methods in *Handbook* and select suitable areas from chart on page 10.)

C.
1. Methods W223,W242
2. Method W244
3. Methods W212,W213
4. Methods B413,B415 (or W223, W242)
5. Method B413

D. RF 511, page 24 Cases 1, 3, 5, or 7

E. 1/8" [Method F142, page 16, Preparation by Other Trades]

F. 2 hours [Method RW522, page 25, Recommended Uses]

G. The bottom edge of the counter top trim must be set the proper distance above the finish floor material to allow clearance for dishwashers, compactors, etc. [Method C611 or C612, page 26, Requirements]

H. Best to minimal (ABCDE) [Grout Specifications Guide, page 10]

I. Yes; with dry-set or latex-portland cement mortar [Method F113, page 12, Note at the bottom of page]

J. Dry-set or latex-portland cement mortar [Method F144, page 17, limitations.]

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #4

PART I

A. Dry wall grout [dry-set grout]

B. Clean water suitable for drinking

C. 15 minutes

D. No more than can be used in about 30 minutes

E. Thoroughly clean

F. No

G. Trowel or squeegee

H. Damp cure under extremely dry conditions

I. "Your skin may be sensitive to cement. Wearing rubber gloves is suggested. Avoid contact with eyes or prolonged contact with skin. In case of contact, flush thoroughly with water. For eyes, get prompt medical attention."

PART II

A. Dense Grout quarry grade [commercial portland cement grout]

B. 50 lbs. (22.7 kilograms)

C. It must be sealed or waxed

D. With clean water in a clean container. Grout should be slowly added to the water and mixed thoroughly until a smooth texture is obtained. Mixture should be allowed to stand 15 minutes. It should then be remixed and used. No more water or dry powder should be added

E. Joints should be dusted with dry Dense Grout and rubbed in a circular motion until they are smooth and flush with tile

F. At least 72 hours after grouting

G. Joints should be damp mopped, and excess grout film should be cleaned from tile surfaces with tile cleaner. Surfaces should then be flushed immediately with water to remove tile cleaner

H. "Bonsal disclaims any and all warranties and guarantees of any sort as to color and appearance of product, at all times, at and after opening of the container."

ANSWERS TO ASSIGNMENT SHEETS

PART III

A. Sanded thin-set mortar for nonporous tile [dry-set mortar]

B. ANSI-A-108.5

C. It should be free of dirt, structurally sound, and dimensionally stable. It should also be frost free and remain above 40°F for 72 hours

D. With pressure apply a skim coat; immediately follow with a second coat of about 3/16"; comb this bed with a notched trowel

E. Maximum of 1/8" thick

F. Exterior installations, floors, and showers

G. Concrete masonry, brick, poured concrete, portland cement plaster, foam glass, gypsum wallboard, old tiled surfaces, marble, gypsum plaster brown coat, gypsum black, expanded polystyrene

H. Plywood, masonite, gypsum plaster white coat, cellulose wallboard, painted surfaces

I. No

J. 50 lbs (22.7 kilograms); approximately 100 sq ft

PART IV

A. Acrylic latex additive

B. [Answer may include any three of the following substrates.]

   1. Masonry
   2. Concrete
   3. Brick
   4. Wonderboard®
   5. Gypsum board (dry areas only)
   6. Sanded ceramic tile or marble
   7. Exterior grade plywood

C. Rubber, synthetic resilient flooring, painted or sealed surfaces

D. Contractor-prepared portland cement and sand thin-set mortars

ANSWERS TO ASSIGNMENT SHEETS

E. To reduce the possibility of incomplete curing

F. 75-90 sq ft

G. ½ gal TA-865 to 1 gal water

H. "If ingested, product may cause slight discomfort; keep out of reach of children"

I. To prevent air being induced into the product, which reduces its strength

PART V

A. Ceramic Tile Adhesive 122 Double Duty

B. Slate and all ceramic tiles for interior installation, installations of "lug" and button-backed tiles are limited to wall applications only

C. No

D. Residential installations over exterior or marine grade plywood; glass mesh mortar units; well cured, dry, dimensionally stable concrete on, above or below grade; and cured plaster

E. Glass mesh mortar units, gypsum board, water-resistant gypsum wallboard (for wet areas), cured white or brown gypsum plaster, cured portland cement plaster, and well cured, dry dimensionally stable concrete

F. Tempered masonite, particle board, cement asbestos board, particle board, and synthetic flooring

G. Do not use for setting fixtures or marble. Do not use for underwater applications or where hydrostatic pressure exists. Exterior or marine grade plywood surfaces should be limited to dry interior floor applications only. When used with large flat backed tiles or when bonding tiles to non-breathing back-ups, the set-up time will be extended.

H. 40-60 sq ft per gallon

I. ANSI A-136.1, Type I & II

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with tile installation materials and guidelines for use. Write the correct numbers in the blanks. Terms and definitions are continued on the next two pages.

______a. Process of forming a tile body by pressing into shape material of a low-moisture, almost dust-like consistency

______b. Layer of fifteen-pound roofing felt or four-mil polyethylene sheeting used to isolate a wire-reinforced mortar bed for tile from the concrete or wood subfloor

______c. Rubberlike

______d. Cracking which occurs in fired glazes or other ceramic coatings due to critical tensile stresses in the glaze

______e. Any material used as a base over which a finished material is to be installed

______f. To spread a bond coat on the back of a ceramic tile just before tile is placed

______g. Material used to adhere ceramic tile to a prepared surface

______h. Process used to form tile or trim units by forcing plastic clay mixtures through an opening of suitable configuration to shape a continuous ribbon of formed clay which is cut to appropriate lengths and widths

______i. Even or unbroken line or surface; being even or on the same line or plane

______j. Tile on which the facial edges have a distinct curvature that results in a slightly recessed joint

______k. Residue deposited on the surface of a material by the crystallization of soluble salts

______l. Two or more materials melted together

1. Backing
2. Bond coat
3. Butter
4. Cleavage membrane
5. Crazing
6. Cushion-edged tile
7. Dust pressed method
8. Efflorescence
9. Elastomeric
10. Extrusion process
11. Flush
12. Fused

TEST

_____m. Modified portland cement or noncement based material used for filling tile joints

_____n. Fit to drink; drinkable

_____o. Elastomeric material used to fill and seal joints; prevents passage of moisture and allows horizontal and lateral movement at joint

_____p. Glazed or unglazed porcelain or natural clay tile formed by the dust-pressed method having six square inches or more of facial area

_____q. Tile with water absorption of 0.5 percent or less

_____r. To compact and smooth grout line with a striking tool

_____s. Period of time in which bond coat is wet to the touch and will adhere to the tile

_____t. Tile with water absorption of more than 7.0 percent

_____u. Backing board consisting of a core of set gypsum surfaced with paper

_____v. Strong paper made from sulfate processed wood pulp

_____w. Tile with water absorption of more than 3.0 percent, but not more than 7.0 percent

_____x. Protuberance on sides of tiles to provide space between tiles for grout lines

_____y. Consistency of cement mortar or grout mixture that will just hang on trowel; if combed material should stand up and show notched trowel ridges

_____z. Method of installing ceramic tile with bonding materials that can be applied to suitable substrates in a uniform coat ranging in thickness after beat in from 1/32" for organic adhesive to 1/8" for dry-set, latex-portland cement, or epoxy mortars

13. Grout
14. Gypsum board
15. Impervious tile
16. Kraft paper
17. Lug spacer
18. Nonvitreous tile
19. No-slump mix
20. Open time
21. Paver tile
22 Potable
23. Sealant
24. Semivitreous tile
25. Strike
26. Thin-set or thin-bed

TEST

______aa. Emulsion of organic, plastic resins or rubber compounds and water

______bb. Tile with water absorption of more than 0.5 percent, but not more than 3.0 percent

______cc. Substance used to coat installed tile to reduce permeability

______dd. That which can be penetrated by liquid or vapor

______ee. Hard, dense tile of uniform composition throughout; derives color and texture from materials of which the body is made

______ff. Colorless or colored ceramic glaze having low gloss

______gg. Concrete glass fiber reinforced backing board

______hh. Trim tile having a concave radius on one edge and a convex radius landing on the opposite edge; often used as the only course of tile above the floor tile

______ii. Trim tile having one edge with a concave radius; used to form a junction between the bottom wall course and floor, or to form an inside corner

______jj. Tile with a fused impervious facial finish composed of ceramic materials fused to body of the tile which may be nonvitreous, semivitreous, vitreous, or impervious

27. Latex additive
28. Sealer
29. Vitreous tile
30. Glazed tile
31. Glass mesh mortar unit
32. Cove
33. Matte glaze
34. Cove base (sanitary)
35. Unglazed tile
36. Permeable

2. Name three examples of places where ceramic tile can be used in residences.

a. ______________________________

b. ______________________________

c. ______________________________

3. Name three factors affecting tile selection and installation.

a. ______________________________

b. ______________________________

c. ______________________________

TEST

4. Name major types of ceramic tile. Write the correct names in the blanks.

Type of Tile	Brief Description	Characteristics
a. ____________	Glazed or unglazed tile made by extrusion process from natural clay or shale; usually has six square inches or more of facial area	Excellent wear under hard service conditions
b. ____________	Glazed tile with a body that is suitable for interior use and which is usually nonvitreous, and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions	Good surface hardness Easy to clean and maintain Fire resistant Chemically resistant to household acids
c. ____________	Glazed or unglazed porcelain or natural clay tile formed by the dust-pressed method having six square inches or more of facial area	Excellent wear under hard service conditions
d. ____________	Tile formed by either dust-pressed or plastic method; usually 1/4" to 3/8" thick and having a facial area of less than six square inches; may be of either porcelain or natural clay composition, and may be either plain or with an abrasive mixture throughout	Nonstaining Excellent wearing qualities

5. Describe types of glazes.

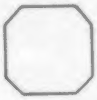
____

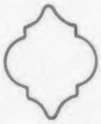
____

____

____

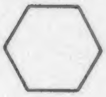
6. Label the following shapes of ceramic tile.



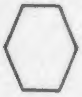


a. ______________________ b. ______________________

TEST



c. ______________________________



d. ______________________________

e. ______________________________

f. ______________________________

7. Match types of trim to their correct ordering numbers. Write the correct numbers in the blanks. A number may be used more than once.

______a. SN-4269
______b. SM-4449
______c. A-3401
______d. SN-4449
______e. SKL- or SKR-8262
______f. SM-4269
______g. S-4269
______h. SC-8262
______i. SCL- or SCR-3419
______j. SCL- or SCR-3401
______k. S-3419
______l. SCL- or SCR-1663
______m. SCL- or SCR-3419-T
______n. S-8262
______o. S-4449
______p. A-1663

1. S-cap (surface bullnose)
2. Base (cove)
3. S-up angle (butterfly)
4. S-down angle
5. Base (sanitary cove)
6. Base (out corner)
7. Out angle
8. Square-in angle
9. Counter trim

TEST

8. Match types of trim to their correct uses. Write the correct numbers in the blanks.

_____a. Used at the top and sides of the field to finish the installation

_____b. Used to trim/join a tiled wall with a tiled floor

_____c. Used at the top outside edge of the field to start the cap in a horizontal and/or vertical direction

_____d. Used at the inside angle to start the cap in a horizontal and/or vertical direction

_____e. Trim for countertop edging

_____f. Trim piece used to change direction on salient angles

_____g. Connecting trim for reentrant angle

1. Base
2. Up angle
3. Down angle
4. Cap
5. Out angle
6. Square in angle
7. Counter trim

TEST

9. Distinguish among suitable prepared backings for thin-set mortar installations in wet and dry areas. Place a check in each appropriate column beside the suitable backings for each installation listed.

	DRY AREA				WET AREA		
BACKING MATERIAL	FLOORS	WALLS	CEILINGS	COUNTER TOPS	FLOORS	WALLS	CEILINGS
A. Gypsum board							
B. Portland cement mortar							
C. Gypsum plaster							
D. Concrete or concrete masonry							
E. Glass mesh mortar unit							
F. Brick							
G. Ceramic tile							
H. Marble							
I. Water-resistant gypsum board							
J. Exterior grade plywood							

TEST

10. Match setting materials used in thin-set installation methods to their correct descriptions. Write the correct numbers in the blanks.

_____a. Mortar/grout system employing emulsified epoxy resins and hardeners with portland cement and silica sand

_____b. Mixture of portland cement with sand and additives imparting water retentivity; used as bond coat for setting tile

_____c. Mixture of portland cement, sand, and special latex additive; used as a bond coat for setting tile

_____d. Prepared organic material, ready to use with no further addition of liquid or powder; cures or sets by evaporation

_____e. Adhesive system employing epoxy resin and epoxy hardener portions

_____f. Mortar system employing epoxy resin and epoxy hardener portions

1. Epoxy mortar
2. Modified epoxy emulsion mortar
3. Organic adhesive
4. Dry-set mortar
5. Latex-portland cement mortar
6. Epoxy adhesive

11. Match types of grouts to their correct descriptions. Write the correct numbers in the blanks.

_____a. Mixture of portland cement and other ingredients to produce a water-resistant, dense, uniformly colored material

_____b. On-the-job mixture of one part portland cement to one part fine graded sand used for joints up to 1/8" wide; 1:2 for joints up to 1/2" wide; 1:3 for joints over 1/2" wide—up to 1/5 part lime may be added

_____c. Mixture of portland cement and additives providing water retentivity

_____d. Mixture of dry-set, sand-portland cement, or commercial portland cement grout with special latex additive

_____e. Grout system employing resin and hardener portions, often containing coarse silica filler

_____f. An engineered elastomeric grout system for interior use employing a single component nonslumping silicone rubber, which upon curing is resistant to staining, moisture, mildew, cracking, crazing, and shrinkage

1. Commercial portland cement
2. Epoxy
3. Dry-set (dry wall)
4. Silicone rubber
5. Sand-portland cement
6. Latex-portland cement

TEST

12. Select from the following list guidelines for mixing and using grout. Write an "X" in the blank before each correct answer.

______a. Keep a set of tools just for mixing, a bucket for grout mixture, and a five-gallon bucket for cleanup water

______b. Mix thoroughly to give a uniform consistency

______c. Use mortar buckets and tools for mixing and applying grout

______d. Use hot or warm water

______e. Always follow manufacturer's directions precisely

______f. Remix grout with water if grout becomes crumbly

______g. Moisten nonvitreous tiles *before* grout is applied

______h. Damp cure or use latex additive

______i. Add powder to liquid after mixing

______j. Use cool, potable water

______k. Always add grout to liquid, *not* liquid to grout

______l. After thorough mixing, wait one-half hour before remixing

______m. Fill joints solidly and remove excess grout from face of tile with good rubber trowel

______n. Strike all joints to make them dense, smooth, and hard

13. Select from the following list characteristics of good grouting. Write an "X" in the blank before each correct answer.

______a. Finish flush to the top of square-edged tile

______b. Rough joints the texture of sandpaper

______c. Tooled or struck to depth of cushion on cushion-edged tile

______d. Cured hard, smooth, and uniform

______e. Soft and powdery

______f. Good color variation

______g. Strong and compact to meet normal wear conditions

TEST

_____h. Slight hairline cracks

_____i. Absence of all grout from face of tile when job is finished

14. State five reasons for grout discoloration.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

15. Select from the following list ways to prevent grout discoloration. Write an "X" in the blank before each correct answer.

_____a. Leave plastic tile spacers in joints

_____b. Leave setting bed material in joints

_____c. Damp cure or cover grout with kraft paper for 72 hours to slow down drying time and to allow grout to dry or cure at an even rate

_____d. Mix grout with as little liquid as possible for proper application

_____e. Cure by covering with polyethylene

_____f. Follow manufacturer's directions

_____g. Acid clean

_____h. Never acid-clean

_____i. Keep setting bed materials out of grout joints

_____j. Clean by flooding with water

_____k. Keep excess water off grouted areas

_____l. Clean only with appropriate cleaners recommended for ceramic tile

TEST

16. Match special products used in tile installations to their correct definitions. Write the correct numbers in the blanks.

______a. Tile assembled into units or sheets to facilitate handling and installation

______b. Backing and underlayment designed for use with ceramic tile in wet or dry areas

______c. Transitional piece between two different finished floor levels

______d. Individual ceramic tiles, factory assembled into pregrouted sheets of various sizes; used for various wall installations

______e. Glazed or unglazed tile having specified physical design or appearance

1. Pregrouted ceramic tile sheets
2. Glass mesh mortar units
3. Mounted tile
4. Threshold
5. Special purpose tile

17. Write meanings of abbreviations commonly used in tile industry.

a. TCA — ________________________________

b. ANSI — ________________________________

c. o.c. — ________________________________

d. ASTM — ________________________________

18. State steps in material estimating.

a. ________________________________

b. ________________________________

c. ________________________________

(NOTE: Test questions 19-22 are assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

19. Estimate amount of materials needed for tile installations.

20. Interpret a work order.

21. Interpret ANSI specifications and TCA *Handbook.*

22. Interpret labels from tile installation products.

INSTALLATION MATERIALS AND GUIDELINES FOR USE
UNIT I

ANSWERS TO TEST

1.

a.	7	k.	8	u.	14	ee.	35
b.	4	l.	12	v.	16	ff.	33
c.	9	m.	13	w.	24	gg.	31
d.	5	n.	22	x.	17	hh.	34
e.	1	o.	23	y.	19	ii.	32
f.	3	p.	21	z.	26	jj.	30
g.	2	q.	15	aa.	27		
h.	10	r.	25	bb.	29		
i.	11	s.	20	cc.	28		
j.	6	t.	18	dd.	36		

2. Answer should include any three of the following
   a. Floors, ceilings, walls
   b. Counter tops
   c. Patios
   d. Fireplace facings and hearths
   e. Heat shields and floor protectors for solid-fuel-burning stoves

3. Answers should include any three of the following
   a. Intended use of room or area
   b. User's budget
   c. Interior decorating trends
   d. Available tile installation materials
   e. Personal preference

ANSWERS TO TEST

4. a. Quarry
   b. Wall
   c. Paver
   d. Mosaic

5. Descriptions should include
   a. Bright — High gloss glaze with or without color
   b. Matte — Low gloss glaze with or without color
   c. Crystalline — Extra heavy glaze produced for use on counter tops and light-duty floor surfaces where abrasion or impact is not excessive

6. a. Octagon
   b. Valencia
   c. Hexagon
   d. Elongated hexagon
   e. Square
   f. Rectangle

7. a. 4
   b. 3
   c. 2
   d. 4
   e. 8
   f. 3
   g. 1
   h. 7
   i. 6
   j. 6
   k. 5
   l. 6
   m. 6
   n. 9
   o. 1
   p. 2

8. a. 4
   b. 1
   c. 3
   d. 2
   e. 7
   f. 5
   g. 6

ANSWERS TO TEST

9.

	BACKING MATERIAL	**DRY AREA**				**WET AREA**		
		FLOORS	**WALLS**	**CEILINGS**	**COUNTER TOPS**	**FLOORS**	**WALLS**	**CEILINGS**
A.	Gypsum board		✓	✓				
B.	Portland cement mortar	✓	✓	✓	✓	✓	✓	✓
C.	Gypsum plaster		✓	✓				
D.	Concrete or concrete masonry	✓	✓	✓	✓	✓	✓	✓
E.	Glass mesh mortar unit	✓	✓	✓	✓	✓	✓	✓
F.	Brick	✓	✓			✓	✓	
G.	Ceramic tile	✓	✓	✓	✓	✓	✓	✓
H.	Marble	✓	✓	✓	✓	✓	✓	✓
I.	Water-resistant gypsum board		✓				✓	
J.	Exterior grade plywood	✓			✓			

10. a. 2 d. 3

b. 4 e. 6

c. 5 f. 1

ANSWERS TO TEST

11. a. 1 d. 6
b. 5 e. 2
c. 3 f. 4

12. a, b, e, g, h, j, k, m, n

13. a, c, d, g, i

14. Answer should include any five of the following
- a. Applying grout before organic adhesive has time to cure properly
- b. Using too much liquid to mix colored grout
- c. Allowing grout to dry too quickly
- d. Applying different depths of grout in the joints
- e. Using too much water on freshly grouted areas
- f. Acid-cleaning
- g. Efflorescence
- h. Excessive glaze on edge of tile
- i. Inadequate mixing
- j. Use of two different batch lots
- k. Failure to remove plastic spacers
- l. Contamination from dirty tools or materials

15. c, d, f, i, k, l

16. a. 3 d. 1
b. 2 e. 5
c. 4

17. a. Tile Council of America
b. American National Standards Institute

ANSWERS TO TEST

c. On center

d. American Society for Testing and Materials

18. a. Check backings for suitablity

b. Check the specifications

c. Check room schedule on the blueprint

19. Evaluated to the satisfaction of the instructor
20. Evaluated to the satisfaction of the instructor
21. Evaluated to the satisfaction of the instructor
22. Evaluated to the satisfaction of the instructor

FLOORS
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to install ceramic tile over a wood floor, previously poured concrete floor, and glass mesh mortar units. This knowledge will be shown by completing assignment sheets, job sheets, and the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with floor tile installation.
2. Select from a list guidelines for floor layout.
3. Select from a list guidelines for installing floors.
4. Interpret ANSI specifications and TCA Handbook guidelines for floor tile installations.
5. Interpret labels from products used in floor tile installations.
6. Demonstrate the ability to
    - a. Lay out floor.
    - b. Install tile over previously poured interior concrete floor.
    - c. Install tile over wood floor.
    - d. Install floor tile over glass mesh mortar units.
    - e. Install tile on exterior floor.
    - f. Grout and cure floor tile.

FLOORS
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order materials planned to supplement unit.

1. Request labels, sample packaging, and materials from manufacturing and distributing companies.

2. *American National Standard Specifications for the Installation of Ceramic Tile, A-108.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

3. *Handbook for Ceramic Tile Installation.* Current edition available from Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

4. *American National Standard Specifications for Ceramic Tile.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

5. Materials and Methods Standards Association (MMSA) *Bulletins.* Available from M.M.S.A. care of H.B. Fuller Company, 315 South Hicks Road, Palatine, Illinois 60067.

6. Ceramic Tile Institute (CTI) *Field Reports.* Available from Ceramic Tile Institute, 700 North Virgil Avenue, Los Angeles, California 90029.

7. Current trade magazines and newsletters, such as *Tile and Decorative Surfaces.*

B. Provide student with objective sheet.

C. Discuss unit and specific objectives.

D. Provide students with information, assignment, and job sheets.

E. Discuss information and assignment sheets.

F. Demonstrate and discuss procedures outlined in job sheets.

G. Prepare mock-ups and/or job sites for completion of job sheets.

H. Provide a wide variety of products and/or their labels for students to complete Assignment Sheet #2.

(NOTE: Assist students in associating specific brand names with the generic materials.)

I. Stress the importance of matching appropriate materials with types of tile installations, and discuss the consequences of using the wrong material.

SUGGESTED ACTIVITIES

J. Teach proper selection of materials for various installations. See TCA *Handbook for Ceramic Tile Installation.*

K. Remind students that answers to the following questions will help them select the proper materials and methods of installation. No job should start without favorable answers to these questions, resolved and agreed upon by all parties concerned.

   1. Is the installation to be interior or exterior?
   2. If interior, will it be in a wet or dry area, wall, floor, or ceiling?
   3. If exterior, is there a potential danger of frost damage?
   4. Is the tile selected suitable for this type of installation?
   5. Is the backing suitable for this type of installation?
   6. Are the selected installation materials and methods suitable for both the tile and backup surface?
   7. Are the job conditions compatible with the installation specifications?

L. Give test after students complete unit and assignment sheets.

II. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Information sheet

   D. Assignment sheets

      1. Assignment Sheet #1 — Interpret ANSI Specifications and TCA Handbook Guidelines for Floor Tile Installations
      2. Assignment Sheet #2 — Interpret Labels from Products Used in Floor Tile Installations

   E. Answers to assignment sheets

   F. Job sheets

      1. Job Sheet #1 — Lay Out Floor
      2. Job Sheet #2 — Install Tile Over Previously Poured Interior Concrete Floor
      3. Job Sheet #3 — Install Tile Over Wood Floor

SUGGESTED ACTIVITIES

4. Job Sheet #4 — Install Floor Tile Over Glass Mesh Mortar Units
5. Job Sheet #5 — Install Tile on Exterior Floor
6. Job Sheet #6 — Grout and Cure Floor Tile

G. Test

H. Answers to test

III. Unit references

A. *American National Standard Specifications for the Installation of Ceramic Tile A-108.* New York, New York: ANSI, 1976.

B. *Ceramic Tile and Allied Products Information Booklet No. 172.* Lansdale, Pennsylvania: American Olean Tile Company, 1980.

C. *Ceramic Tile Manual.* Los Angeles, California: Building News, Inc., 1979.

D. *Ceramic Tile Shapes and Sizes.* New York, New York: Tile Council of America, Inc., 1958.

E. *1982 Handbook for Ceramic Tile Installation.* Princeton, New Jersey: Tile Council of America, 1981.

F. *Tilesetting Workbook.* Sacramento, California: California State Department of Education, 1975.

FLOORS
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Bond coat — Material used to adhere a ceramic tile to a prepared surface

B. Butter — To spread a bond coat on back of a ceramic tile just before tile is placed

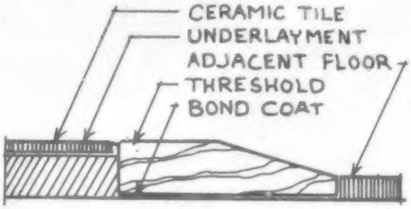
C. Haze — Cloudy film that may appear on tiles after grouting

D. Starting line — Squared line where tile is to start

E. Threshold — Tile, stone, marble, or slate shaped piece used to join floors of different heights; sometimes called a "saddle" (Figure 1)

EXAMPLE:

FIGURE 1



F. Underlayment patching — Filler material consisting of a latex additive and mortar; used to fill uneven spaces during preparation of masonry surface

G. Waste — Anything not reusable left over from tile installation job

EXAMPLES: Empty tile cartons, paper, small tile cuts, mixed grout

H. Expansion joint — Gap left between sections of materials to permit expansion or contraction without cracking

I. Subfloor — Surface over which a floor finish such as carpet, linoleum, wood, or tile is laid

(NOTE: If subfloor is wood, underlayment such as plywood or glass mesh mortar units must be installed over subfloor prior to the tile installation. Deflection of subfloor should not exceed $^{1}/_{360}$ of span, including live and dead load.)

INFORMATION SHEET

J. On center (o.c.) — Distance between centers of framing members such as studs and joists

K. Laminate — To bond or press together in layers

II. Guidelines for floor layout

A. Avoid cuts of less than one-half tile

B. If at all possible, center layout at most conspicuous area

C. Use actual tiles placed loosely on floor

D. Double-check all calculations and measurements

E. Show owner proposed layout before installing tile, if possible

F. Square starting lines and compensate for out-of-square room at wall cuts

III. Guidelines for installing floors

A. Read and follow directions on work order carefully

B. Inspect floor to be tiled

(NOTE: Floor should be clean, structurally sound, have little deflection, and be free of holes and uneven places.)

C. Accurately measure area for tile layout

D. Avoid using tile cutter or making cuts on tiled area

(NOTE: Small chips may get under tile that you will be installing.)

E. Avoid putting pressure on newly installed tile

(NOTE: Pressure will cause tile to slip out of line or may break the bond between tile and setting material.)

F. Keep tile joints straight and of even width

G. Clean all surfaces as you go

H. Follow manufacturer's directions carefully with each product

I. Work toward exit so that the last tiles are installed at exit

J. Use kneeling boards if it becomes necessary to work on tiled surface

FLOORS
UNIT II

ASSIGNMENT SHEET #1 — INTERPRET ANSI SPECIFICATIONS AND TCA HANDBOOK GUIDELINES FOR FLOOR TILE INSTALLATIONS

NAME ____ SCORE ________________

A tile setter must follow manufacturer's directions and recognized specifications to correctly install tile. Two sources of specifications and guidelines are those set forth by the American National Standards Institute and the Tile Council of America. Practice in interpreting these publications will assist the tile setter in doing the best job possible.

Using the *American National Standard Specifications for the Installation of Ceramic Tile* and the *Handbook for Ceramic Tile Installation*, answer the following questions regarding floor tile installations.

PART I — ANSI specifications

A. Is an organic adhesive suitable for installing tile on floors in heavy-traffic areas? ____

B. Is particle board a suitable backing material for tile floor installations? ____________

C. Name five characteristics required of the backing surface in preparation for installing floor tiles using epoxy.

1. ____
2. ____
3. ____
4. ____
5. ____

D. Can organic adhesive be used to install tile on a concrete patio slab if vapor barrier is used? ____

E. What is the maximum joist spacing allowed for tile installed over plywood floors using epoxy? _____________ inches

PART II — *Handbook* guidelines

A. What are the method numbers for the following installations?

1. Wood subfloor with organic adhesive — ____________________
2. Patio with dry-set mortar — ____________________
3. Interior concrete floor with latex-portland cement mortar — ____________________
4. Glass mesh mortar units with dry-set mortar — ____________________

ASSIGNMENT SHEET #1

B. Where should expansion joints be used for exterior floors using thin-set installation?

____

____

____

C. What size joints are required between glass mesh mortar units used as underlayment?
____________ inch

How must the joints be finished? ____

____

D. What is the maximum variation allowed in a plywood surface used as underlayment for epoxy installations? ____

E. What is the maximum variation allowed in an interior concrete slab used as subflooring for organic adhesive installations?

____

FLOORS
UNIT II

ASSIGNMENT SHEET #2 — INTERPRET LABELS FROM PRODUCTS USED IN FLOOR TILE INSTALLATIONS

NAME ______________________________ SCORE ______________

Reading labels and following their directions are important tasks that a tile setter does. Using products as the manufacturer intended is a key to a more attractive tile installation. Also, when products are used appropriately, the life of the tile installation will be extended.

Select labels from tile products used in the installation of floors. At least one example of each of the following should be used to complete the label information sheets on the next pages: latex additive, grout, modified epoxy emulsion mortar, and dry-set mortar mix.

ASSIGNMENT SHEET #2

PART I — LABEL INFORMATION

A. Type of product **Latex additive** ____________________

____

B. Brand name ________________________________

____

C. Manufacturer's name and address ____________________

____

____

D. Directions for use (amount to use and how to use) __________

____

____

____

E. Surfaces on which product can be used ________________

____

F. Surfaces on which product should not be used ____________

____

G. Caution statements ____________________________

____

____

____

H. Net contents ________________________________

____

I. List of ingredients ____________________________

____

____

____

ASSIGNMENT SHEET #2

PART II — LABEL INFORMATION

A. Type of product **Grout**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

ASSIGNMENT SHEET #2

PART III — LABEL INFORMATION

A. Type of product **Modified epoxy emulsion mortar**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

ASSIGNMENT SHEET #2

PART IV — LABEL INFORMATION

A. Type of product **Dry-set mortar mix** ____________________

____

B. Brand name ____________________

____

C. Manufacturer's name and address ____________________

____

____

D. Directions for use (amount to use and how to use) ____________________

____

____

____

E. Surfaces on which product can be used ____________________

____

F. Surfaces on which product should not be used ____________________

____

G. Caution statements ____________________

____

____

____

H. Net contents ____________________

____

I. List of ingredients ____________________

____

____

____

FLOORS
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

(NOTE: Answers are taken from ANSI A108-1976 and *1983 Handbook for Ceramic Tile Installation.* Use of other editions may lead to answers different than those given here.)

PART I

A. No (AN-2.6.3.1)

B. No (AN-2.5.3.2.1)

C. (AN-2.6.4.1)

  1. Free of ridges and depressions
  2. Sound
  3. Clean
  4. Dry
  5. ¼"

D. No (AN-2.6.3.2)

E. 16 (AN-3.5.1)

PART II

A.
  1. F-142 (p.16)
  2. F-102 (p.11)
  3. F-113 (p.12)
  4. F-144 (p.17)

B. F-102 (p.11)

  1. Where tile work abuts restraining surfaces such as walls, curbs, parapets, columns, pipes, drains, etc.
  2. Directly over joints in structural floor including construction joints or cold joints

C. ⅛"; filled with dry-set or latex-portland cement mortar (p.17, F-144)

ANSWERS TO ASSIGNMENT SHEETS

D. 1/8" in 10'-0"; adjacent edges of plywood sheets shall not be more than 1/32" above or below each other (p.16, F-143)

E. 1/16" in 3'-0" (p.13, F-116)

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

FLOORS
UNIT II

JOB SHEET #1 — LAY OUT FLOOR

I. Tools and materials

A. Steel measuring tape

B. Steel square

C. Chalk line

D. Pencil

E. Tile

II. Procedure

(NOTE: This procedure describes a square layout. Other patterns, such as broken-joint and herringbone, are also used for floors, but the beginning tile setter should master the square pattern before attempting other layouts.)

A. Measure longest wall

B. Determine center of longest wall by dividing length by two and mark center point

(NOTE: Double-check measurements and locations of marks.)

C. Begin at center line and lay tiles loose along wall toward one end wall to determine cut

(NOTE: There should be more than one-half tile cut at the wall if cutting is required.)

D. Make adjustments if cut is less than one-half tile

1. Adjust joint width

(NOTE: It is often possible to eliminate the need for a cut or to ensure a cut of more than one-half tile by adjusting the width of the joints slightly. Remember that using 4 1/4" tiles, there will be approximately 30 joints along a 12-foot wall. An adjustment of 1/32" in each joint would permit an adjustment of approximately one inch.)

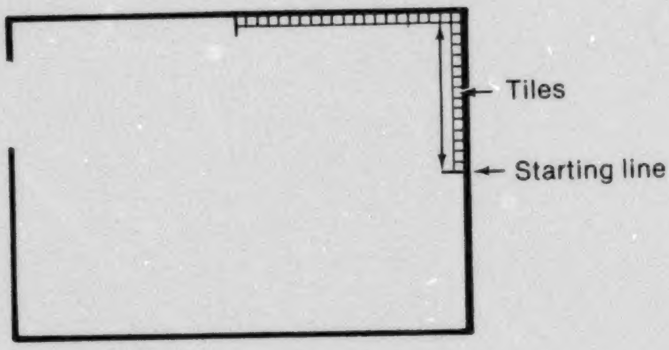
2. Mark a line on one side or the other of the center line which can be used as a starting line to permit proper cuts at the end walls

E. Repeat steps A-D for one of the end walls

JOB SHEET #1

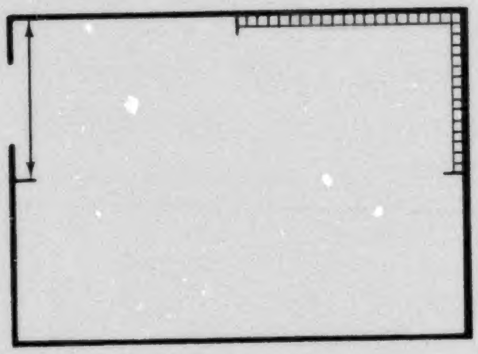
F. Measure the distance from the long wall to the starting line along the end wall (Figure 2)

FIGURE 2



G. Measure and mark an equal distance from the long wall on the opposite end wall (Figure 3)

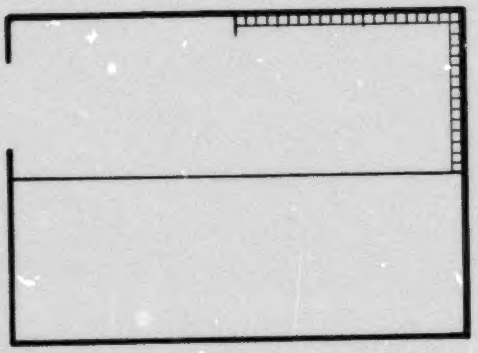
FIGURE 3



H. Chalk a line the length of room between starting points of the two end walls (Figure 4)

(NOTE: This line is parallel to the long wall.)

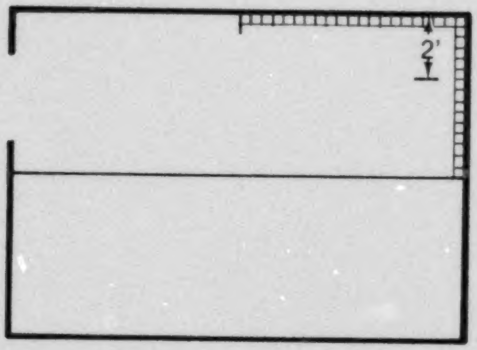
FIGURE 4



JOB SHEET #1

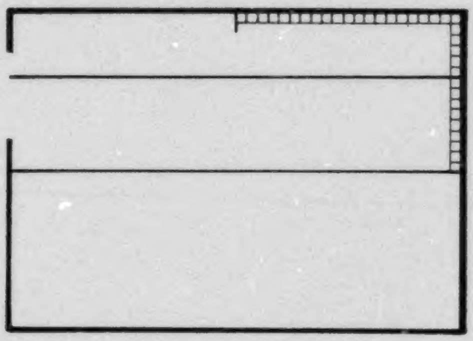
I. Measure from the long wall to a tile joint approximately two feet from the long wall in the course of tiles laid out along the end wall (Figure 5)

FIGURE 5



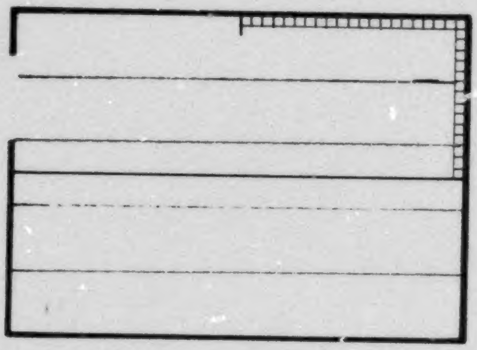
J. Measure this same distance along the opposite end wall and chalk a second line parallel to the long wall (Figure 6)

FIGURE 6



K. Continue to measure and mark lines parallel to the long wall at tile joints approximately two feet apart across the width of the room (Figure 7)

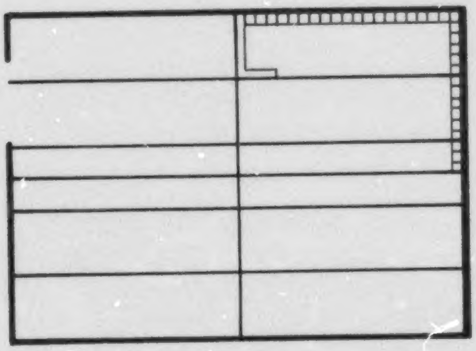
FIGURE 7



JOB SHEET #1

L. Use the square to chalk a line perpendicular to the long wall at the starting point; mark the line the width of the room (Figure 8)

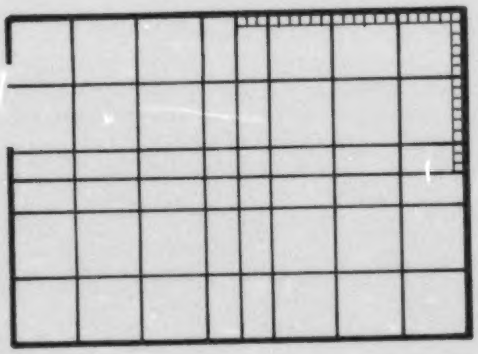
FIGURE 8



M. Beginning at the perpendicular starting line, measure and mark lines perpendicular to the long wall at tile joints approximately two feet apart the length of the room (Figure 9)

(NOTE: Use the square to make sure that the lines running the width of the room are perpendicular to the lines which run parallel to the long wall. This procedure produces a grid squared to the long wall.)

FIGURE 9



FLOORS
UNIT II

JOB SHEET #2 — INSTALL TILE OVER PREVIOUSLY POURED INTERIOR CONCRETE FLOOR

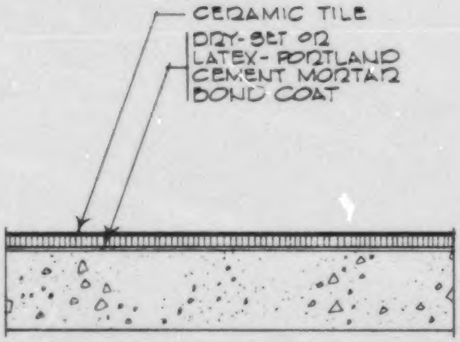
I. Detail and guidelines from TCA *Handbook* (Figure 10)

FIGURE 10

Concrete Subfloor

Dry-Set Mortar or
Latex-Portland Cement Mortar

F113-82



Recommended Uses:
- on plane, clean concrete.
- on slab-on-grade construction where no bending stresses occur.
- on properly cured structural slabs where limited bending stresses occur and expansion joints are installed in accordance with Method EJ711.

Limitations:
- use Method F111 over precast concrete floor systems.

Requirements:
- slab to be well cured, dimensionally stable and free of cracks, waxy or oily films, and curing compounds.
- mortar bond coat 3/32" min.

Materials:
- Dry-Set mortar—conform with ANSI A118.1.
- latex-portland cement mortar — conform with ANSI A118.4.
- water—potable.
- expansion joints (see Page 28).
- grout—specify type (see Pages 7 & 10).

Preparation by Other Trades:
- slab to have steel trowel and fine broom finish with no curing compounds used.
- slope, when required, to be in subfloor.
- max. variation in the slab shall not exceed 1/8" in 10'-0" from the required plane.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, etc.
- directly over joints in structural floor including construction joints or cold joints.
- expansion joints mandatory in accordance with Method EJ711.

Installation Specifications:
- ANSI A108.5.

JOB SHEET #2

(NOTE: The following instructions are pertinent to a dry floor using the thin-bed method.)

II. Tools and materials

A. Tools

1. Nippers
2. Rub brick (stone)
3. Hammer
4. Rubber grouting trowel (floor-type)
5. Beating block (4" × 8")
6. Kneeling boards
7. Square-notched trowel (properly notched trowel for type of tile being used)
8. Pails
9. Gauging trowel
10. Rubber mallet
11. Sponges (good assortment)
12. Straightedge
13. Tile cutter
14. Tile saw
15. Margin trowel
16. Steel measuring tape or wood folding rule
17. Steel square (2′)
18. Pencil
19. Joint spacers
20. Terry cloth towels
21. Chalk line
22. Joint striking tool

JOB SHEET #2

B. Materials

1. Dry-set mortar (TCA 759 floor mix)
2. Commercial portland cement grout
3. Bullnose trim or threshold
4. Materials for barricade
5. Clean, potable water

III. Procedure to prepare surface for installation

A. Check floor for proper preparation by other trades

1. Check for holes and uneven places

(CAUTION: Slab should have been finished with a steel trowel and fine broom without the use of curing compounds. Maximum variation in the slab should not exceed 1/8" in 10'-0" from the required plane. Refer to ANSI specifications and TCA guidelines.)

2. Fill all holes and depressions with latex mortar or dry set mortar
3. Let cure overnight if thickness of patch is more than 1/8" thick
4. Mechanically remove grease or wax from floor if necessary

B. Lay out grid

C. Determine starting point

(NOTE: Install tile in such a way that you will be at an exit when the job is completed. Do not work on tiled surfaces unless absolutely necessary. If it becomes necessary to work on tiled surface, always use a kneeling board. Generally, you should begin tile installation along the wall opposite the exit.)

JOB SHEET #2

IV. Procedure for tile installation

(NOTE: Dry-set mortar or latex-portland cement mortar are the recommended bond coats for residential use over concrete subfloors. Organic adhesives are also suitable for some tile installations.)

A. Mix dry-set mortar

(CAUTION: Before mixing dry mortar, be sure that the properly-notched trowel is available for specified application.)

(NOTE: Properly-notched trowel depends on backing of tile. After beat-in, there must be a finished mortar bed thickness of $^3/_{32}$" to $^1/_8$" with 100 percent contact between tile and mortar bed and no voids in the mortar.)

1. Follow manufacturer's instructions
2. Add dry-set mortar powder to liquid and mix with gauging trowel to get a smooth, no-slump trowelable mixture
3. Let stand for approximately fifteen minutes
4. Remix

(CAUTION: Do not add additional powder or liquid.)

B. Spread dry-set mortar

1. Check open time of mortar, and spread only what you can tile within this time

(CAUTION: Temperature and humidity govern open time of mortar. Therefore, it is critical that the surface of the combed mortar bed remain wet to the touch at all times.)

2. Spread mortar away from chalked lines with flat side of square-notched trowel to get a good mechanical bond

(NOTE: Leave chalk lines visible at all times. You will need to stay within these lines with the tile.)

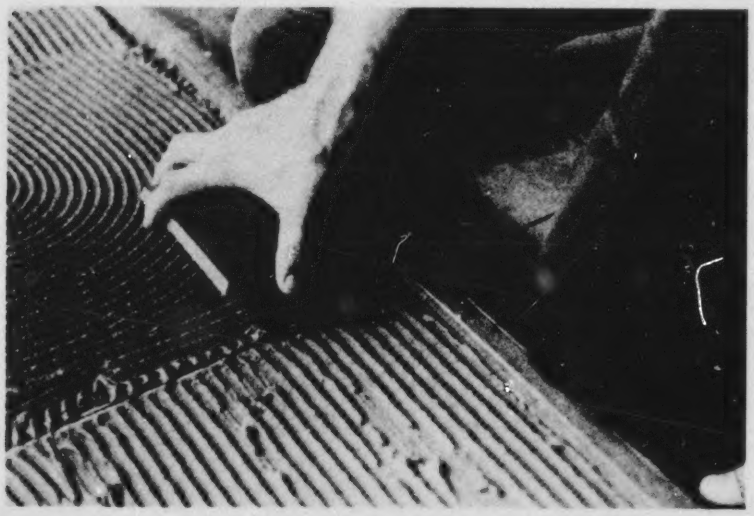
3. Spread additional mortar and comb mortar bed with notched side of trowel

JOB SHEET #2

C. Install tile

1. Place straightedge along a chalk line and butt the tile against straightedge, as desired (Figure 11)

FIGURE 11



JOB SHEET #2

2. Keep the tile evenly spaced within grid lines using spacers between each tile if desired

   (NOTE: If used, spacers should be removed from each section of the grid as the installation for that section is completed.)

3. Press and twist each tile into place

4. Beat tiles into mortar bed with beating block and hammer

   (NOTE: Maintain as close to 100 percent coverage as possible on the back of each tile.)

5. Complete tile installation working toward exit, making and installing cuts in each grid as required

6. Clean tiles in each installed section with damp sponge

   (NOTE: If you must get on a tiled surface, use kneeling boards to support your weight.)

7. Finish door opening using threshold or bullnose as necessary

   a. Measure distance from edge of tile field to underneath center of door or to edge of adjoining floor covering

   b. Cut bullnose or threshold, if necessary, measured distance less joint width

      (NOTE: Cut door jamb or trim if necessary to fit.)

   c. Smooth cut with rub brick

8. Check the job thoroughly after you have installed the entire area

9. Clean tools, remove all waste, and leave work surfaces clean

10. Barricade all openings to keep traffic from tiled area

11. Let floor cure at least forty-eight hours before grouting

D. Grout tile as required for type of grout and width of joint

E. Clean work surfaces, tools, and floor; remove all waste from premises

F. Damp cure for at least 72 hours

G. Barricade area to prevent traffic during curing period

FLOORS
UNIT II

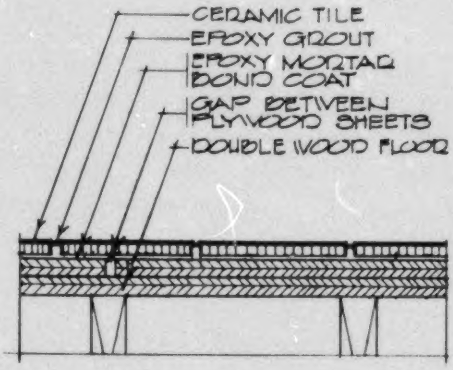
JOB SHEET #3 — INSTALL CERAMIC TILE OVER WOOD FLOOR

I. Detail and guidelines from TCA *Handbook* (Figure 12)

FIGURE 12

Wood Subfloor

Epoxy Mortar and Grout **F143-82**



Recommended Uses:
- over wood floors where resistance to foot traffic in better residential, normal commercial and light institutional use is desired with thin-bed construction.
- where water, chemical and stain resistance is desired.

Requirements:
- deflection not to exceed 1/360 of span, including live and dead load.
- double wood floor required except in some residential uses.
- gap in top layer of exterior grade plywood required.
- gap between exterior grade plywood sheets to be filled with epoxy when it is spread for setting tile.
- with single floors in residential use, solid blocking required under all end joints of plywood.

Materials:
- epoxy mortar — ANSI A118.3.
- epoxy grout — ANSI A118.3.
- modified epoxy emulsion mortar — certified by manufacturer as suitable for intended use.

Preparation by Other Trades:
- subfloor — 5/8" plywood or 1" nominal boards when on joists 16" o.c.
- overlay — 5/8" exterior grade plywood with gap of 1/4" between sheets.
- residential use — overlay of 1/2" exterior grade plywood or single layer of 5/8" exterior grade plywood permissible. Maintain 1/4" gap between sheets and provide solid blocking under single floor.
- max. variation in the plywood surface shall not exceed 1/8" in 10' - 0" from the required plane. Adjacent edges of plywood sheets shall not be more than 1/32" above or below each other.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- required over structural joints.

Installation Specifications:
- ANSI A108.6.

JOB SHEET #3

II. Tools and materials

A. Tools

1. Nippers
2. Tile saw
3. Margin trowel
4. Floor-type rubber grouting trowel
5. Steel measuring tape or wood folding rule
6. Sponges
7. Nylon scouring pads
8. Pails
9. Gauging trowel
10. Rubber gloves
11. Straightedges
12. Beating block
13. Rubber mallet
14. Joint spacers
15. Square-notched trowel (properly notched trowel for type of tile being used)
16. Claw hammer
17. Sander
18. Power circular saw
19. Square (2′)
20. Chalk line
21. Rub brick (stone)

B. Materials

1. Tile
2. Epoxy mortar

JOB SHEET #3

3. Epoxy grout
4. Clean, potable water
5. Galvanized, screw-type nails (1 1/2")

III. Procedure to prepare floor for installation

A. Check existing floor for proper preparation by other trades

(CAUTION: Residential subflooring should be 5/8" plywood or 1" nominal boards on joists 16" on center with an overlay of 1/2" or 5/8" exterior grade plywood. A single layer of 5/8" exterior grade plywood is also acceptable. Refer to ANSI specifications and TCA guidelines.)

1. Check for loose boards
2. Nail if necessary, using 1 1/2" screw-type nails

   (NOTE: Floor must be solid.)

3. Cut 1/4" joints between plywood overlay sheet if not accomplished by subflooring installers
4. Check joints and sand even if necessary

   (CAUTION: Maximum variation in the plywood surface shall not exceed 1/8" in 10'-0" from required plane. Adjacent edges of plywood sheets shall not be more than 1/32" above or below each other. Refer to ANSI specifications and TCA guidelines.)

5. Clean all dust from floor

B. Lay out tile

IV. Procedure for mixing and spreading epoxy mortar

(NOTE: Epoxy mortar is the preferred, thin-set bond coat for residential use over wood subfloors. Organic adhesive is also acceptable for some tile installations.)

(CAUTION: Wear rubber gloves when handling epoxy materials.)

A. Mix epoxy mortar

(CAUTION: Before mixing any mortar, be sure that the properly-notched trowel is available for specified application.)

(NOTE: Properly-notched trowel depends on backing of tile. After beat-in, there must be a finished epoxy mortar bed thickness of 1/8" with 80 percent contact between tile and mortar bed.)

1. Follow manufacturer's instructions

JOB SHEET #3

2. Determine open time and mix only what you can install in that time

   (CAUTION: Temperature affects open time. Be sure that bond coat remains plastic during installation.)

B. Spread epoxy mortar

(NOTE: The 1/4" joints between exterior grade plywood sheets must be filled solid with epoxy mortar.)

1. Spread epoxy mortar within chalked lines with flat side of square-notched trowel to get a good mechanical bond
2. Apply additional epoxy and comb with notched side of trowel

V. Procedure for installing tile

A. Place straightedge along a chalk line wall and butt tile against straightedge, as desired

B. Keep tile evenly spaced within grid lines using spacers between each tile if desired

(CAUTION: Remove any epoxy from face of tile immediately.)

C. Press and twist each tile into place

D. Beat tiles into setting material with beating block and hammer

(NOTE: Maintain a minimum of 80 percent coverage on the back of each tile.)

E. Complete tile installation working toward exit, making and installing cuts in each grid as required

(NOTE: Remove spacers if used as you complete each grid section.)

F. Clean tiles in each installed section with damp sponge

(NOTE: If you must get on a tiled surface, use kneeling boards to support your weight.)

G. Finish door opening using threshold or bullnose as necessary

1. Measure distance from edge of tile field to underneath center of door or to edge of adjoining floor covering
2. Cut bullnose or threshold if necessary, measured distance less joint width

   (NOTE: Cut door jamb or trim if necessary to fit.)

3. Smooth cut with rub brick

JOB SHEET #3

H. Check the job thoroughly after you have installed the entire area

I. Clean tools, remove all waste, and leave work surface clean

J. Barricade all openings to keep traffic from tiled area

K. Let floor cure at least sixteen hours before grouting

L. Grout tile

M. Clean work surfaces, tools, and floor, and remove all waste from area

(CAUTION: Remove excess epoxy immediately with water to prevent it from setting.)

N. Barricade area from traffic for twenty-four hours and do not allow heavy equipment on installation for at least forty-eight hours

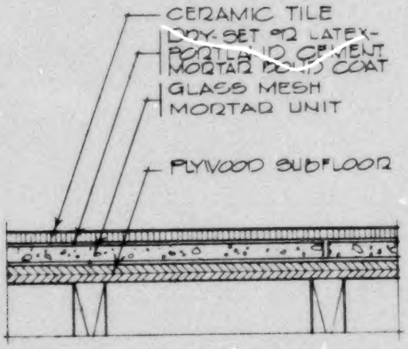
(CAUTION: Temperature in installed area should remain relatively constant for first eight hours after installation.)

FLOORS
UNIT II

JOB SHEET #4 — INSTALL FLOOR TILE OVER GLASS MESH MORTAR UNITS

I. Detail and guidelines from TCA *Handbook* (Figure 13)

FIGURE 13 **Dry-Set Mortar or Latex-Portland Cement** **F144-83**



Recommended Uses:
- over structurally sound plywood where light weight construction is a factor.
- where water resistance is desired.
- where better light commercial residential floor construction is desired with thin-bed construction.
- eliminates necessity of recessing subfloor to accommodate portland cement mortar bed.

Limitations:
- will provide bond for presanded Dry-Set mortar or latex-portland cement mortar only.
- waterproof membrane shall be provided where a waterproof floor is required.

Requirements:
- deflection shall not exceed 1/360 of the span, including live and dead loads.
- maximum spacing of floor joists is 16" o.c.
- 1/8" wide spacing between units to be filled with Dry-Set or latex-portland cement mortar.
- all joints between units ends to be aligned over floor joists.
- laminate units to subfloor with latex-portland cement mortar.
- sheets to be fastened through subfloor into joists with galvanized nails, screw type nails, or other corrosion-resistant fasteners.
- surface of units to be clean and free of dirt, dust or oily film.

Materials:
- underlayment glass mesh mortar unit—certified by the manufacturer as suitable for intended use.
- Dry-Set mortar—conform with ANSI A118.1.
- latex-portland cement mortar — conforms with ANSI A118.4.
- expansion joints—see Method EJ411.
- grout—specify type (see Pages 7 & 10).

Preparation by Other Trades:
- subfloor — 1/2" exterior grade plywood on joists at 16" o.c.
- max. variation in plywood surface shall not exceed 1/8" in 10' - 0" from the required plane.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- optional except in large areas.
- expansion joints mandatory with quarry tile abutting rigid surfaces.

Installation Specifications:
- glass mesh mortar unit — in accordance with manufacturer's literature.
- ceramic tile — ANSI A108.5.

JOB SHEET #4

II. Tools and materials

   A. Tools

      1. Nippers
      2. Tile saw
      3. Margin trowel
      4. Floor-type rubber grouting trowel
      5. Steel measuring tape or wood folding rule
      6. Sponges
      7. Nylon scouring pad
      8. Pails
      9. Chalk line
      10. Carbide-tipped scoring tool
      11. Straightedges
      12. Square (2′)
      13. Beating block
      14. Rubber mallet
      15. Joint spacers
      16. Claw hammer
      17. Notched trowel (properly notched trowel for type of tile being used.)
      18. Gauging trowel
      19. Terry cloth towels
      20. Rub brick

   B. Materials

      1. Tile
      2. Glass mesh mortar units
      3. Dry-set mortar mix

JOB SHEET #4

4. Latex-portland cement mortar mix
5. Latex additive
6. Grout
7. Galvanized roofing nails, 1½" screw-type

III. Procedure to prepare floor for installation

A. Check existing floor for proper installation by other trades

(CAUTION: Subfloor should be a minimum of ½" exterior grade plywood on joists 16" on center. Refer to ANSI specifications and TCA guidelines.)

1. Check for loose boards
2. Nail if necessary, using 1 ½" screw-type nails

   (NOTE: Floor must be solid.)

3. Check joints and sand even if necessary

   (CAUTION: Maximum variation in plywood subflooring must not exceed ⅛" in 10′-0" from the required plane. Refer to ANSI specifications and TCA guidelines.)

4. Clean all dust from floor

B. Install glass mesh mortar units

(NOTE: Follow manufacturer's instructions for installation.)

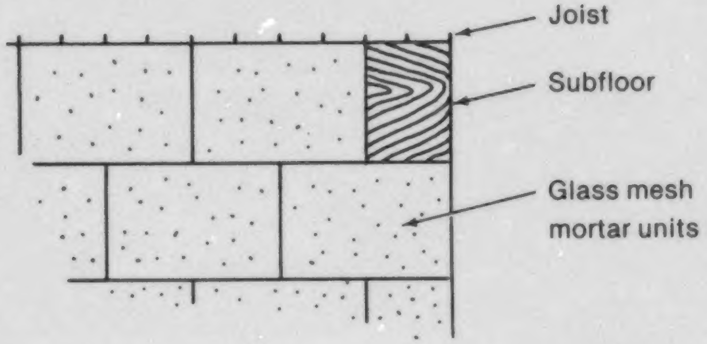
1. Loose lay glass mesh mortar units over floor area, scoring and snapping units to fit

JOB SHEET #4

2. Stagger end joints of glass mesh mortar units (Figure 14)

   (CAUTION: Joints between the ends of units should be aligned over floor joists.)

FIGURE 14



3. Leave 1/8"-3/16" joints between all units

   (NOTE: The joints will be filled with mortar during tile installation.)

4. Mix latex-portland cement mortar and use to laminate glass mesh mortar units to ply wood sub flooring

   a. Carefully follow manufacturer's instructions

   b. Mix thoroughly to a soft, self-leveling mixture

   c. Let stand for 15 minutes

   d. Remix

5. Remove one unit, spread mortar on subfloor, and replace in original position

   (NOTE: Be sure that you maintain the required 1/8"-3/16" gap between glass mesh mortar units.)

6. Nail unit in place using 1 1/2" galvanized screw-type nails 6-8" apart along both widths and lengths

7. Repeat steps 5 and 6 for remaining glass mesh mortar units

C. Lay out floor for tile installation

JOB SHEET #4

IV. Procedure to install tile

A. Mix dry-set mortar or latex-portland cement mortar

(CAUTION: Before mixing any mortar, be sure that the properly-notched trowel is available for specified application.)

(NOTE: Properly notched trowel depends on backing of tile. After beat-in, there must be a finished mortar bed thickness of $^3/_{32}$" to $^1/_8$" with 100 percent contact between tile and mortar bed and no voids in the mortar.)

1. Follow manufacturer's instructions

2. Add dry-set mortar powder to liquid and mix with gauging trowel to a smooth, no-slump trowelable mixture

3. Let stand for approximately fifteen minutes

4. Remix

(CAUTION: Do not add additional powder or liquid.)

B. Fill joints with mortar

C. Spread mortar

1. Check open time of mortar, and spread only what you can tile within this time

(CAUTION: Temperature and humidity govern open time. Therefore, it is critical that the surface of the notched mortar bed remain wet to the touch at all times.)

2. Spread mortar away from chalked lines with flat side of square-notched trowel to get a good mechanical bond

(NOTE: Leave chalk lines visible at all times. You will need to stay within these lines with the tile.)

3. Apply additional mortar and comb with notched side of trowel

D. Install tile

1. Place straightedge along chalk line and butt the tile against straightedge, as desired

JOB SHEET #4

2. Keep the tile evenly spaced within grid lines using spacers between each tile if desired

   (NOTE: If used, spacers should be removed from each section of the grid as the installation for that section is completed.)

3. Press and twist each tile into place

4. Beat tiles into mortar bed with beating block and hammer

   (NOTE: Maintain as close to 100 percent coverage as possible on the back of each tile.)

5. Complete tile installation working toward exit, making and installing cuts in each grid as required

6. Clean tiles in each installed section with damp sponge

   (NOTE: If you must get on a tiled surface, use kneeling boards to support your weight.)

7. Finish door opening using threshold or bullnose as necessary

   a. Measure distance from edge of tile field to underneath center of door or to edge of adjoining floor covering

   b. If necessary, cut bullnose or threshold measured distance less joint width

      (NOTE: Cut door jamb or trim if necessary to fit.)

8. Check the job thoroughly after you have installed the entire area

9. Clean tools, remove all waste, and leave work surfaces clean

10. Barricade all openings to keep traffic from tiled area

11. Let floor cure at least forty-eight hours before grouting

E. Grout tile

F. Clean work surfaces, tools, and floor, and remove all excess waste from premises

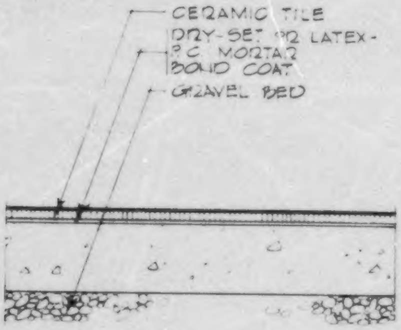
G. Barricade from traffic for at least seventy-two hours

FLOORS
UNIT II

JOB SHEET #5 — INSTALL TILE ON EXTERIOR FLOOR

I. Detail and guidelines for TCA *Handbook* (Figure 15)

FIGURE 15 **Dry-Set Mortar or Latex-Portland Cement Mortar** **F102-83**



Recommended Uses:
- exterior floors, decks or patios where membrane is not used and where positive drainage below slab is provided.

Requirements:
- slab same as Method F113.
- sloped slab required to provide complete surface drainage.
- gravel bed or other means of drainage below slab is required.
- expansion joints are mandatory.
- mortar bond coat 3/32" min.
- cover completed tile work and keep damp for 7 days.

Materials:
- Dry-Set mortar—conform with ANSI A118.1.
- latex-portland cement mortar — conform with ANSI A118.4.
- expansion joints (see Page 28).
- grout—specify type (see Pages 7 & 10).

Preparation by Other Trades:
- provide subsurface drainage.
- slope slab for complete drainage.
- steel trowel and fine broom finish slab; max. variation in the slab shall not exceed 1/8" in 10' - 0" from the required plane.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- where tile work abuts restraining surfaces such as walls, curbs, parapets, columns, pipes, drains, etc.
- directly over joints in structural floor including construction joints or cold joints.

Installation Specifications:
- ANSI A108.5.

JOB SHEET #5

II. Tools and materials

A. Tools

1. Nippers
2. Rub brick (stone)
3. Chalk line
4. Rubber grouting trowel
5. Beating block
6. Hammer
7. Kneeling board
8. Square-notched trowel (properly notched trowel for type of tile)
9. Pails
10. Rubber mallet
11. Sponges (good assortment)
12. Straightedges
13. Tile cutter
14. Tile saw
15. Margin trowel
16. Gauging trowel
17. Steel measuring tape or wood folding rule
18. Steel square (2 ft)
19. Pencil
20. Terry cloth towel

B. Materials

1. Dry-set mortar (TCA 759 floor mix)
2. Commercial portland cement grout

JOB SHEET #5

3. Tiles and trim as required

4. Clean, potable water

5. Latex additive

III. Procedure to prepare surface for installation

A. Check area to be tiled

1. Check for holes and uneven places

(CAUTION: The maximum variation in the slab must be within 1/8" of the required plane in 10'-0".)

2. Fill all holes and depressions with latex-portland cement mortar

(CAUTION: Allow patches of 1/8" or more thick to cure overnight.)

3. Check for adequate drainage if required

(CAUTION: In areas subject to freeze-thaw cycles, the subflooring must slope to provide adequate drainage. The slope should be no less than 1/4" per foot and should eliminate puddling.)

4. Check for proper surface finish

(CAUTION: Slab should have a steel trowel and fine broom finish.)

5. Check to see that surface is free of cracks, dirt, oil, wax, curing compounds, and other coatings

(NOTE: Mechanically remove contaminants.)

6. Check temperature

(CAUTION: Do not install tile if the temperature of the slab is above 100°F. Do not install tile if temperature is likely to fall below 50°F during installation. Check setting and grouting mixture instructions for any further restrictions.)

C. Lay out area for tile installation

(NOTE: Expansion joints and control joints must not be covered by tile.)

JOB SHEET #5

IV. Procedure for installing tile

(NOTE: Dry-set mortar and latex-portland cement mortar are the recommended bond coats for use on exterior concrete slabs. If latex-portland cement is to be used, check manufacturer's instructions for restrictions and limitations.)

A. Mix dry-set mortar

(CAUTION: Before mixing any mortar, be sure that the properly notched trowel is available for specified application.)

(NOTE: Properly notched trowel depends on backing of tile. After beat-in, there must be a finish mortar bed thickness of $^3/_{32}$" to $^1/_8$" with 100 percent contact between tile and mortar bed and no voids in the mortar.)

1. Follow manufacturer's instructions

2. Add dry-set mortar powder to water and mix with gauging trowel to a smooth, no-slump trowel mixture

3. Let stand for approximately fifteen minutes

4. Remix

(CAUTION: Do not add additional powder or liquid.)

B. Spread dry-set mortar

1. Check open time of mortar and spread only what you can use within this time

(CAUTION: Temperature and humidity govern open time of mortar. Therefore, it is critical that the surface of the combed mortar bed remain wet to the touch at all times.)

2. Spread mortar away from chalked lines with flat side of square notched trowel to get a good mechanical bond

(NOTE: Leave chalk lines visible at all times. You will need to stay within these lines with the tile.)

3. Be careful not to fill in expansion and control joints

C. Install tile

(CAUTION: Be sure that tile is recommended by the manufacturer as suitable for the climatic conditions of the locality.)

1. Place straightedge along a chalk line and butt the tile against straightedge, as desired

JOB SHEET #5

2. Keep the tile evenly spaced within grid lines using spacers between each tile if desired

   (NOTE: If used, spacers should be removed from each section of the grid as the installation for that section is completed.)

3. Press and twist each tile into place

4. Beat tiles into mortar bed with beating block and hammer

   (NOTE: Maintain as close to 100 percent coverage as possible on back of each tile.)

5. Complete tile installation working toward exit, making and installing cuts in each grid as required

6. Leave openings over expansion and control joints; cut tiles if necessary

   (CAUTION: Width of openings for expansion joints must be at least as wide as joint in slab. Openings should be 3/8" to 1/2"; tiled areas exposed to open sky should be finished with 3/4" wide expansion joints. Refer to ANSI specifications and TCA guidelines.)

7. Clean tiles in each installed section with damp sponge

   (NOTE: If you must get on tiled surface, use kneeling boards to support your weight.)

8. Cut and install trim as necessary

9. Check the job thoroughly after you have installed the entire area

10. Clean tools, remove all waste, and leave work surfaces clean

11. Barricade tiled area to keep traffic off surface

12. Let area cure at least 48 hours before grouting

D. Grout as required for type of tile and width of joint

E. Clean work surfaces, tools, and deck; remove all waste from premises

F. Damp cure finished area for seven days

G. Barricade area from traffic during cure period

FLOORS
UNIT II

JOB SHEET #6 — GROUT AND CURE FLOOR TILE

I. Detail and guidelines from TCA *Handbook* (Figure 16)

FIGURE 16

GROUT SPECIFICATION GUIDE

Printed through the courtesy of the Materials & Methods Standards Association. A rubber faced trowel should be used when grouting glazed tile with sanded grout.		**GROUT TYPE** See p. 7 for complete description								
		Commercial Portland Cement		**Sand-Portland Cement**	**Dry-Set**	**Latex Portland Cement** (3)	**Mastic** (3)	**Epoxy** (1) (6)	**Furan** (1) (6)	**Silicone or Urethane** (2)
		Wall Use	**Floor Use**	**Wall-Floor Use**	**Wall-Floor Use**					
TILE TYPE	GLAZED WALL TILE (More than 7% absorption)	●			●	●	●			
	CERAMIC MOSAICS	●	●	●	●	●		●		●
	QUARRY, PAVER & PACKING HOUSE TILE	●	●	●		●		●	●	
AREAS OF USE	Dry and intermittently wet areas	●	●	●	●	●	●	●	●	●
	Areas subject to prolonged wetting	●	●	●	●	●		●	●	●
	Exteriors	●	●	●	●	● (4)		● (4)	● (4)	
PERFORMANCE	Stain Resistance (5)	D	C	E	D	B	A	A	A	A
	Crack Resistance (5)	D	D	E	D	C	C	B	C	A Flexible
	Colorability (5)	B	B	C	B	B	A	B	Black Only	Restricted

(1) Mainly used for chemical resistant properties.

(2) Special tools needed for proper application. Silicone, urethane and modified polyvinylchloride used in pregrouted ceramic tile sheets. Silicone grout should not be used on kitchen countertops or other food preparation surfaces unless it meets the requirements of FDA Regulation No. 21, CFE 177.2600.

(3) Special cleaning procedures and materials recommended.

(4) Follow manufacturer's directions.

(5) Five performance ratings — Best to Minimal (A B C D E).

(6) Epoxies are recommended for prolonged temperatures up to 140°F, high temperature resistant epoxies and furans up to 350°F.

JOB SHEET #6

II. Tools and materials

- A. Tools
  - 1. Rubber grouting trowel
  - 2. Kneeling boards
  - 3. Pails
  - 4. Gauging trowel
  - 5. Sponges (good assortment)
  - 6. Margin trowel
  - 7. Terry cloth towels
  - 8. Joint striking tool
- B. Materials
  - 1. Grout (appropriate for type of installation and joint width)
  - 2. Clean, potable water

III. Procedure to prepare floor for grouting

- A. Ensure that mortar has cured properly before grouting

  (NOTE: See ANSI specifications and TCA guidelines.)

- B. Check to make sure that all spacers have been removed
- C. Determine type of grout to be used

  (NOTE: Commercial portland cement grout with latex additive is recommended for most floor installations. However, tile installed over concrete subfloors, especially exterior installations, can be grouted with dry-set. Refer to the appropriate section of this job sheet for mixing the required grout.)

IV. Procedures to mix grouts

- A. Mix commercial portland cement grout with latex additive
  - 1. Mix latex additive in a clean pail according to latex manufacturer's directions

JOB SHEET #6

2. Stirring vigorously with gauging trowel, add small amounts of portland cement mixture to the latex solution

3. Mix well until mixture is of a smooth, no slump consistency

4. Let stand for fifteen minutes

5. Remix

(CAUTION: Do not add additional powder or liquid.)

B. Mix dry-set grout

(NOTE: Dry-set portland cement may be mixed with latex additive using the procedure described in step A.)

1. Follow manufacturer's instructions carefully

2. Add dry ingredients to clean, potable water, stirring with gauging trowel

3. Mix well until mixture is of a smooth, no slump consistency

4. Let stand fifteen minutes

5. Remix

(CAUTION: Do not add additional powder or liquid.)

C. Mix epoxy grout

(CAUTION: Store epoxy materials at a temperature of 60°F to 90°F for a period of 48 hours prior to use.)

1. Follow the manufacturer's directions exactly

(CAUTION: Always wear rubber gloves when mixing or working with epoxy materials.)

JOB SHEET #6

2. Determine open time and mix only what you can use in that time

   (CAUTION: Temperature affects open time. Reduce allowable open time for high temperatures.)

V. Procedures for grouting

- A. Place two five-gallon pails with clean, potable water at work site
- B. Place a small amount of grout on tiled floor

  (NOTE: Begin grouting at a point which will allow you to work toward an exit, completing the job without having to work over freshly grouted areas.)

- C. Force grout firmly into tile joints with floor-type rubber grouting trowel, using pressure on trowel and moving in several directions to make sure all joints are well-filled

  (CAUTION: Fill all skips and gaps. Force the grout into joints with sufficient pressure to eliminate air pockets and voids.)

  (NOTE: Keep buildup of grout off grouting trowel.)

- D. Clean excess grout from tiled surfaces with trowel, transferring excess grout to ungrouted sections of field

  (CAUTION: Do not allow epoxy grouts to harden on face of tile. Use nylon scouring pads for stubborn buildup.)

- E. Clean surface with damp terry cloth towel using a diagonal motion across the face of the tiles and joints

  (NOTE: Change water in pails often to keep it clean.)

- F. Finish tile joints as required
  1. Leave joints flush with the surface for square-edge tiles
     - a. Use a sponge diagonally across the tile joints for joints less than 1/8"
     - b. Use terry cloth towels diagonally across the tile joints for joints 1/8" or more
  2. Strike joints on cushion-edge tile if joint is 1/8" wide or less

     (NOTE: Joints should be smooth and contoured so that the grout is even with the depth of the cushion.)

JOB SHEET #6

H. Use dry terry cloth towels to polish haze which may appear as surface dries

(NOTE: Grout should fill all joints with no mortar showing. The finished grout should be uniform in color, smooth and without voids, pin holes, or low spots. The tile should be clean.)

I. Clean work surfaces, tools, and floor; remove all waste from area

J. Allow tiled area to dry

K. Cure tile installation as required

   1. Damp mop floor

   2. Cover with kraft paper

   3. Allow to cure in accordance with ANSI specifications, TCA guidelines, and manufacturer's instruction

   (NOTE: Epoxy grouts do not require damp curing.)

L. Barricade area during grout curing period

FLOORS
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with floor tile installation. Write the correct numbers in the blanks.

_____a. Tile, stone, marble, or slate shaped piece used to join floors of different heights; sometimes called a "saddle"

_____b. To spread a bond coat on back of a ceramic tile just before tile is placed

_____c. To bond or press together in layers

_____d. Anything not reusable left over from tile installation job

_____e. Surface over which a floor finish such as carpet, linoleum, wood, or tile is laid

_____f. Cloudy film that may appear on tiles after grouting

_____g. Squared line where tile is to start

_____h. Gap left between sections of material to permit expansion or contraction without cracking

_____i. Filler material consisting of a latex additive and mortar; used to fill uneven spaces during preparation of masonry surface

_____j. Distance between centers of framing members such as studs and joists

_____k. Material used to adhere ceramic tile to a prepared surface

1. Bond coat
2. Butter
3. Haze
4. Starting line
5. Threshold
6. Underlayment patching
7. Waste
8. Expansion joint
9. Subfloor
10. On center (o.c.)
11. Laminate

2. Select from the following list guidelines for floor layout. Write an "X" in the blank before each correct answer.

_____a. Show owner proposed layout before installing tile, if possible

_____b. If at all possible, center layout at most conspicuous area

TEST

_____c. Start tile layout at wall opposite door

_____d. Avoid cuts of less than one-half tile

_____e. Use actual tiles placed loosely on floor

_____f. Begin tile layout at entrance to room

_____g. Square starting lines and compensate for out-of square floor at wall cuts

_____h. Widen joints as necessary to keep tile square to all walls

_____i. Double-check all calculations and measurements

3. Select from the following list guidelines for installing floors. Write an "X" in the blank before each correct answer.

_____a. Read and follow directions on work order carefully

_____b. Use kneeling boards if it becomes necessary to work on tiled surface

_____c. Inspect floor to be tiled

_____d. Make sure that grouted joints are depressed and not flush with surface of tiles

_____e. Accurately measure area for tile layout

_____f. Avoid using tile cutter or making cuts on tiled area

_____g. Always add more water and powder when remixing grout

_____h. Avoid putting pressure on newly installed tile

_____i. Keep tile joints straight and of even width

_____j. Make cuts as small as possible

_____k. Clean all surfaces as you go

_____l. Install cuts before field

_____m. Follow manufacturer's directions carefully with each product

TEST

_____n. Grout tile as it is installed

_____o. Work toward exit so that the last tiles are installed at exit

(NOTE: Test questions 4, 5, and 6 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

4. Interpret ANSI specifications and TCA guidelines for floor tile installations.

5. Interpret labels from products used in floor tile installations.

6. Demonstrate the ability to

   a. Lay out floor.

   b. Install tile over previously-poured concrete floor.

   c. Install tile over wood floor.

   d. Install floor tile over glass mesh mortar units.

   e. Install tile on exterior floor.

   f. Grout and cure floor tile.

FLOORS
UNIT II

ANSWERS TO TEST

1.

a.	5	g.	4
b.	2	h.	8
c.	11	i.	6
d.	7	j.	10
e.	9	k.	1
f.	3		

2. a, b, d, e, g, i
3. a, b, c, e, f, h, i, k, m, o
4. Evaluated to the satisfaction of the instructor
5. Evaluated to the satisfaction of the instructor
6. Performance skills evaluated to the satisfaction of the instructor

COUNTER TOPS AND BACKSPLASHES
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to lay out and install ceramic tile over a wood and a glass mesh mortar unit counter top. Installation will include a tile backsplash. This knowledge will be shown by completing assignment sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with installing counter tops and backsplashes.
2. Select from a list guidelines for counter top and backsplash layout.
3. Select from a list guidelines for installing counter tops and backsplashes.
4. Interpret ANSI specifications and TCA guidelines for counter top and backsplash tile installation.
5. Interpret labels from products used in counter top and backsplash tile installation.
6. Demonstrate the ability to
    a. Lay out various counter top and backsplash designs.
    b. Install counter top backsplash.
    c. Install tile over wood counter top.
    d. Install tile over glass mesh mortar units on counter top.
    e. Grout counter top and backsplash.

COUNTER TOPS AND BACKSPLASHES
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials planned to supplement unit.

      1. Request labels, sample packaging, and materials from manufacturing and distributing companies.

      2. *American National Standard Specifications for the Installation of Ceramic Tile, A108.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

      3. *Handbook for Ceramic Tile Installation.* Current edition available from Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

      4. *American National Standard Specifications for Ceramic Tile.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.

      5. Materials and Methods Standards Association (MMSA) *Bulletins.* Available from MMSA in care of H. B. Fuller Company, 315 South Hicks Road, Palatine, Illinois 60067.

      6. Ceramic Tile Institute (CTI) *Field Reports.* Available from Ceramic Tile Institute, 700 North Virgil Avenue, Los Angeles, California 90029.

      7. Current trade magazines and newsletters, such as *Tile and Decorative Surfaces.*

   B. Provide students with objective sheet.

   C. Discuss unit and specific objectives.

   D. Provide students with information, assignment, and job sheets.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Prepare mock-ups or arrange for job sites for job sheets.

   H. Provide a wide variety of products and/or their labels for students to complete Assignment Sheet #2.

      (NOTE: Assist students in associating specific brand names with the generic material.)

   I. Stress the importance of matching appropriate materials with types of tile installations, and discuss the consequences of using the wrong material.

SUGGESTED ACTIVITIES

J. Teach proper selection of materials for various installations. See *Handbook for Ceramic Tile Installation.*

K. Remind students that answers to the following questions will help them select the proper materials and methods of installation. No job should start without favorable answers to these questions, resolved and agreed upon by all parties concerned.

  1. Is the installation to be interior or exterior?
  2. If interior, will it be in a wet or dry area, wall, floor, or ceiling?
  3. If exterior, is there a potential danger of frost damage?
  4. Is the tile selected suitable for this type of installation?
  5. Is the backing suitable for this type of installation?
  6. Are the selected installation materials and methods suitable for both the tile and backup surface?
  7. Are the job conditions compatible with the installation specifications?

L. Give test after students complete unit and assignments.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Assignment sheets

  1. Assignment Sheet #1 — Interpret ANSI Specifications and TCA Guidelines for Counter Top and Backsplash Tile Installations
  2. Assignment Sheet #2 — Interpret Labels from Products Used in Interior Floor and Counter Top Tile Installations

E. Answers to assignment sheets

F. Job sheets

  1. Job Sheet #1 — Lay Out Various Counter Top and Backsplash Designs
  2. Job Sheet #2 — Install Counter Top Backsplash
  3. Job Sheet #3 — Install Ceramic Tile Over Wood Counter Top

SUGGESTED ACTIVITIES

4. Job Sheet #4 — Install Tile Over Glass Mesh Mortar Units on Counter Top

5. Job Sheet #5 — Grout Counter Top and Backsplash

G. Test

H. Answers to test

III. Unit references

A. *American National Standard Specifications for the Installation of Ceramic Tile A-108.* New York, New York: ANSI, 1976.

B. *Ceramic Tile and Allied Products Information Booklet No. 172.* Lansdale, Pennsylvania: American Olean Tile Company, 1980.

C. *Ceramic Tile Manual.* Los Angeles, California: Building News, Inc., 1979.

D. *Ceramic Tile Shapes and Sizes.* New York, New York: Tile Council of America, Inc., 1958.

E. *1982 Handbook for Ceramic Tile Installation.* Princeton, New Jersey: Tile Council of America, 1981.

F. *Tilesetting Workbook.* Sacramento, California: California State Department of Education, 1975.

COUNTER TOPS AND BACKSPLASHES
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Backsplash — Wall area behind and sometimes at end(s) of counter top

   B. Bond coat — Material used to adhere the back of a ceramic tile to a prepared surface

   C. Butter — To spread a bond coat on back of a ceramic tile just before tile is placed

   D. Deck — Top surface of counter top

   E. Haze — Cloudy film that may appear on tiles after grouting

   F. Laminate — To bond or press together in layers

      EXAMPLE: Glass mesh mortar unit is laminated to counter front edge

   G. Starting line — Squared line where tile is to start

   H. Waste — Anything not reusable left over from tile installation job

      EXAMPLES: Empty tile cartons, paper, small tile cuts, mixed grout

   I. Filler — Cut tile used to fill in a run of tile in the field; sometimes called a "dutchman"

II. Guidelines for counter top layout (Job Sheet #1)

   (NOTE: Tiled counter tops in both the kitchen and bathroom are two of the most often requested installations in the tilesetting trade. Every tile setter must know the basics of laying out a counter top. A tile setter who is proficient at layout is always in demand.)

   A. Experiment until you have a layout with as few small cuts as possible

   B. If at all possible, center entire layout at most conspicuous area

   C. Begin with full tile at cap if possible

   D. Use actual tiles placed loosely on deck

   E. Square starting lines and compensate for out-of-square deck at back wall cut

INFORMATION SHEET

   F. If backsplash is to be installed, allow for backsplash tile thickness plus joint at back wall

   G. Double-check all calculations and measurements

   H. Show owner proposed layout before installing tile, if possible

III. Guidelines for installing counter tops and backsplashes

   A. Read and follow directions on work order carefully

   B. Check area carefully for holes and uneven places

   C. Accurately measure area for tile layout

   D. Avoid using tile cutter or making cuts on tiled area

   (NOTE: Small chips may get under tile that you will be installing.)

   E. Avoid putting pressure on newly installed tile

   (NOTE: Pressure will cause tile to slip out of line or break bond between tile and bond coat.)

   F. Keep tile joints straight and of even width

   G. Clean all surfaces as you go

   H. Follow manufacturer's directions carefully with each product

COUNTER TOPS AND BACKSPLASHES
UNIT III

ASSIGNMENT SHEET #1 — INTERPRET ANSI SPECIFICATIONS AND TCA GUIDELINES FOR COUNTER TOP AND BACKSPLASH TILE INSTALLATIONS

NAME ________________________________ SCORE ____________

A properly installed job is possible only if trade specifications are followed exactly. The tile setter can assure the customer of an attractive and lasting installation by using products properly, applying job skills, and adhering to ANSI specifications and TCA guidelines.

Answer the following questions about counter top and backsplash installation using the *American National Standard Specifications for the Installation of Ceramic Tile* and TCA *Handbook for Ceramic Tile Installation.*

PART I — ANSI Specifications

A. What is the maximum variation allowed in a wall prepared for tile installation such as a gypsum board backsplash? ____________________

B. When using organic adhesive for tile installation on counter tops, you should attain at least an average contact between tile back and bond coat of ____________________ percent.

C. What average thickness should be used for an epoxy bond coat during the installation of mosaic tiles? ____________________

D. What is the minimum amount of time which must elapse after installation before grouting tile set with epoxy? ____________________

E. What is the minimum amount of time which must elapse after installation before grouting tile set with organic adhesive? ____________________

PART II — TCA Guidelines

A. What restriction is placed on the distance between the floor and the bottom edge of tile trim used on the front of counter tops?

____

____

____

____

____

ASSIGNMENT SHEET #1

B. List the three mortars which can be used for counter top installations on glass mesh mortar units.

1. ______________________________
2. ______________________________
3. ______________________________

C. What thickness and grade of plywood is required for counter top decking to allow installation of tile using thin set methods?

____

____

____

D. What additional restriction is placed on the preparation of plywood decking if epoxy mortar is to be used for tile installation?

____

____

____

E. How must the tile setter finish the joints between plywood sheets used in counter top decking during the application of an epoxy bond coat?

____

____

____

____

COUNTER TOPS AND BACKSPLASHES
UNIT III

ASSIGNMENT SHEET #2 — INTERPRET LABELS FROM PRODUCTS USED IN INTERIOR FLOOR AND COUNTER TOP TILE INSTALLATIONS

NAME ______________________________ SCORE ______________

Reading labels and following their directions are important tasks that a tile setter does. Using products as the manufacturer intended is a key to a more attractive and trouble-free tile installation. Also, when products are used appropriately, the life of the tile installation will be extended.

Select from tile products used in the installation of counter tops. At least one example of each of the following should be used to complete the label information sheets on the next pages: latex additive, grout, modified epoxy emulsion mortar, and dry-set mortar mix.

ASSIGNMENT SHEET #2

PART I — LABEL INFORMATION

A. Type of product **Latex additive** ____________________

B. Brand name ____________________

C. Manufacturer's name and address ____________________

D. Directions for use (amount to use and how to use) ____________________

E. Surfaces on which product can be used ____________________

F. Surfaces on which product should not be used ____________________

G. Caution statements ____________________

H. Net contents ____________________

I. List of ingredients ____________________

ASSIGNMENT SHEET #2

PART II — LABEL INFORMATION

A. Type of product **Grout** ______

B. Brand name ______

C. Manufacturer's name and address ______

D. Directions for use (amount to use and how to use) ______

E. Surfaces on which product can be used ______

F. Surfaces on which product should not be used ______

G. Caution statements ______

H. Net contents ______

I. List of ingredients ______

ASSIGNMENT SHEET #2

PART III — LABEL INFORMATION

A. Type of product **Modified epoxy emulsion mortar**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

ASSIGNMENT SHEET #2

PART IV — LABEL INFORMATION

A. Type of product **Dry-set mortar mix** ______________________

B. Brand name ______________________

C. Manufacturer's name and address ______________________

D. Directions for use (amount to use and how to use) ______________________

E. Surfaces on which product can be used ______________________

F. Surfaces on which product should not be used ______________________

G. Caution statements ______________________

H. Net contents ______________________

I. List of ingredients ______________________

COUNTER TOPS AND BACKSPLASHES
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

(NOTE: Answers are taken from ANSI A 108-1976 and *1983 Handbook for Ceramic Tile Installation*. Use of other editions may lead to answers different from those given here.)

PART I

A. 1/8" in 8 feet (A-3.3.10)

B. 95 (A-4.2.2.4.2)

C. 1/16" (A-4.4.2.1.3)

D. 16 hours (A-4.4.3.2)

E. 24 hours (A-4.2.3.2)

PART II

A. Allow clearance for dishwashers, compactors, etc. (p. 26, C612-83)

B. The following in any order (p. 6):

  1. Dry-set mortar
  2. Latex-portland cement mortar
  3. Modified epoxy mortars

C. 3/4", exterior grade (p. 26, C612-83)

D. 1/4" gap at plywood joints (p. 26, C612-83)

E. Must be completely filled with epoxy mortar (p. 26, C612-83)

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

COUNTER TOPS AND BACKSPLASHES
UNIT III

JOB SHEET #1 — LAY OUT COUNTER TOP AND BACKSPLASH

I. Tools and materials

   A. Steel measuring tape or wood folding rule

   B. Tile cutter

   C. Carbide nippers

   D. Rub brick (stone)

   E. Tile saw

   F. Claw hammer

   G. Steel square

   H. Rough sandpaper

   I. Electric hand saw

   J. Pencil or chalk

   K. Tile

   L. Selection of trim and angle units

   M. Screw-type nails

JOB SHEET #1

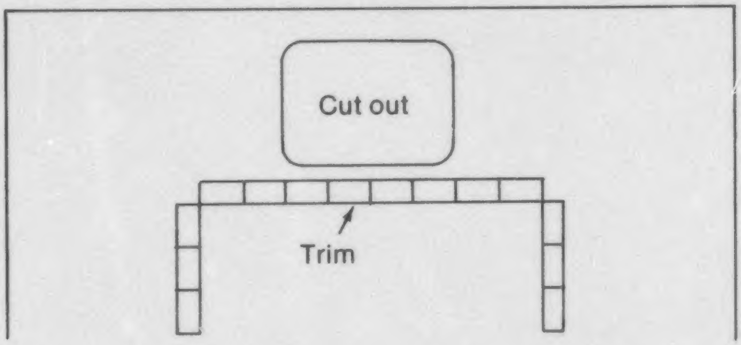
II. Procedure for layout

(NOTE: Layout is very important and can be the most time-consuming aspect of counter top installation. A good layout should have balanced cuts; straight, even joints; no cuts less than one-half tile, if possible; and full tiles along trim. To meet these standards you will have to experiment with different layouts by laying loose tile on the deck.)

A. Lay trim tile loose across front of counter (Figure 1)

(NOTE: Trim all exposed counter top edges, continuing the trim along each side of L- or U-shaped counters. Allow space for inside corner trim pieces if required.)

FIGURE 1

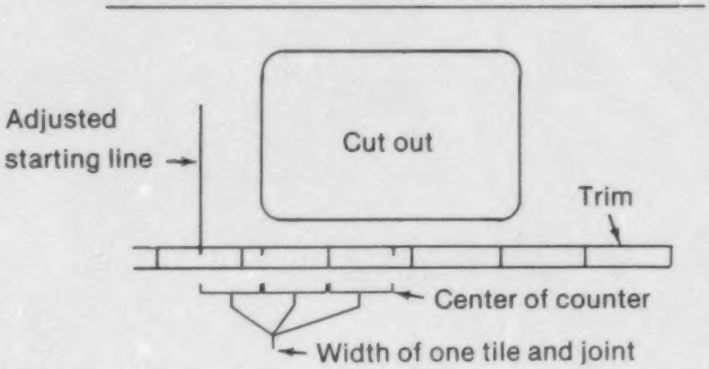


B. Determine starting line(s)

1. Measure length of straight counter top and mark center

(NOTE: If the center of the counter is at a cut-out, measure from the center to one side of the cut and mark a line. The distance from the center should be equal to the width plus joint of enough tiles to move the starting line away from the cut-out. See Figure 2.)

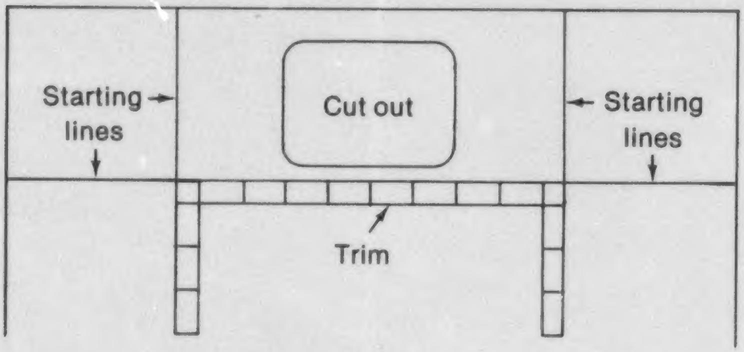
FIGURE 2



JOB SHEET #1

2. For L- or U-shaped counter tops, draw lines parallel to and even with inside edges of trim (Figure 3)
    a. Align square with edge of trim
    b. Extend lines to wall

FIGURE 3

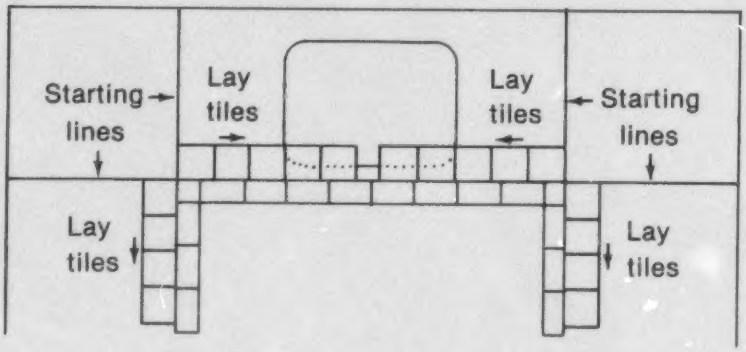

Starting lines
Cut out
Starting lines
Trim

C. Loose lay first row of field tile next to trim pieces (Figure 4)

(NOTE: Lay tile so that first row on all counter edges is a full tile. This may require overlapping tiles.)

1. Begin at starting line(s)
2. Lay tiles from starting line(s) along trim tiles at edge(s) of counter

FIGURE 4


Starting lines
Lay tiles
Lay tiles
Starting lines
Lay tiles
Lay tiles

JOB SHEET #1

D. Determine presence of factors which affect layout (Figure 5)

1. End cuts

   (NOTE: All cut tiles should be over one-half tile if possible.)

2. Sink or appliance cut-outs

   (NOTE: Cuts on sides of cut-outs should be at least one-half tile. When tile field surrounds cut-out, cuts on each of cut out should be equal if possible.)

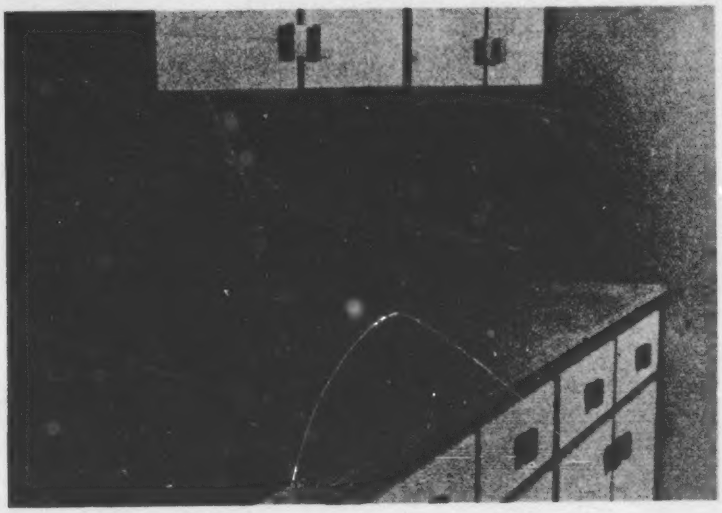
3. Window in field of backsplash

   (NOTE: Backsplash joints should be aligned with tile joints on counter top deck. Cuts on sides of window should be at least one-half tile. When tile field surrounds window, cuts on each side of window should be equal if possible.)

4. Cuts because of shape of counter

   (NOTE: First row of tile should be full tile at each edge of counter if possible.)

FIGURE 5



JOB SHEET #1

E. Adjust field tile locations

1. Adjust joint width

   (NOTE: It may be possible to eliminate cuts or increase width of tile cuts at ends, windows, or cut-outs by adjusting the width of the joints. Remember that all joints must be straight and equal in width.)

2. Adjust location of starting line for straight counter

   (NOTE: On straight counter top designs, it may be possible to ensure proper cuts and centering tiles along cut-outs by shifting the starting line. Do not shift the starting lines on L- or U-shaped counter tops.)

3. Cut filler tile if required for U-shaped counter top

   (NOTE: The first row of field tiles along the base side of a U-shaped counter top should align with the starting lines. If this lay out leads to a wide joint between those tiles started from the right and those started from the left or if the tiles overlap, an adjustment is required. If adjusting the joint widths does not allow proper layout, a filler tile will be required.)

   a. Measure to the center of the base side of the U and mark it

   b. Lay tiles loose along first row of field tile, beginning at the left and right starting lines

      (CAUTION: Be sure joint width is the same as that used for the rest of the layout.)

   c. Leave open the space in the middle which will not accept a full tile

   d. Measure the open space

   e. Subtract the width of two tile joints from the width of the opening

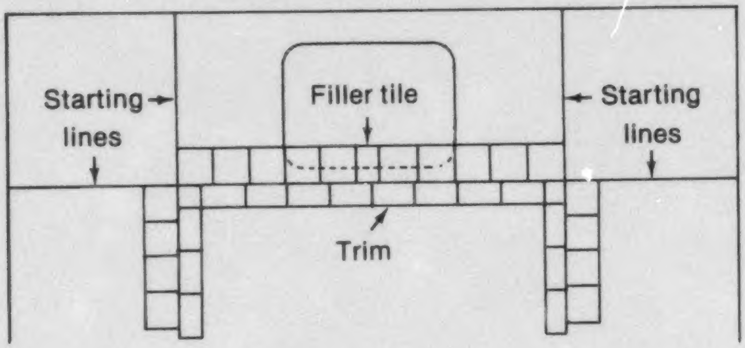
      (NOTE: This gives you the required width of the filler tile.)

JOB SHEET #1

f. Cut a filler tile of the required width and place in lay out (Figure 6)

(NOTE: Often the filler tile will be adjacent to the front of the sink. This location helps to hide the filler tile. Also, note that filler tiles used on the deck of the counter top will require filler tiles in the field of the backsplash to align joints.)

FIGURE 6



F. Determine and cut corner trim if necessary

G. Lay corner trim loosely in place

H. Determine other trim cuts

1. For straight counter tops

    a. Align trim joints with field tile if tile and trim are same size; cut trim to match field tile and cuts

    b. Adjust trim tile starting line or joint width if necessary for tile and trim of different sizes; cut trim at wall if required

    (NOTE: If possible, center trim across front of counter. Keep joint width as close to field tile joint width as possible.)

2. For L- or U-shaped counter tops with closed ends

    (NOTE: A "closed end" is one that butts up against a wall so that the end of the counter is not exposed.)

    a. Align trim joints with field tile if tile and trim are same size; cut trim to match field tile end cuts

JOB SHEET #1

b. Adjust trim tile starting line or joint width if necessary for tile and trim of different sizes; cut trim at wall if required

(NOTE: Keep joint width as close to field tile joint width as possible.)

3. For L- or U-shaped counter tops with open ends

(NOTE: An "open end" is one that does not butt up against a wall. The end of the counter is exposed and must be trimmed.)

a. Align trim joints with field tile if tile and trim are same size; cut trim to match field tile end cuts

b. For tile and trim of different widths, center tile along front edges of counters (Figure 7)

(NOTE: A balanced arrangement of the trim pieces presents the best appearance. These steps allow the tile setter to center the trim pieces between the corner pieces.)

1) Begin trim layout from two corners of one side and lay trim between the corners

(NOTE: An L-shaped counter top open on the end(s) and the sides of a U-shaped counter top will be trimmed between an inside corner and an outside corner. The base side of a U-shaped corner will be trimmed between two inside corners. See Figure 7.)

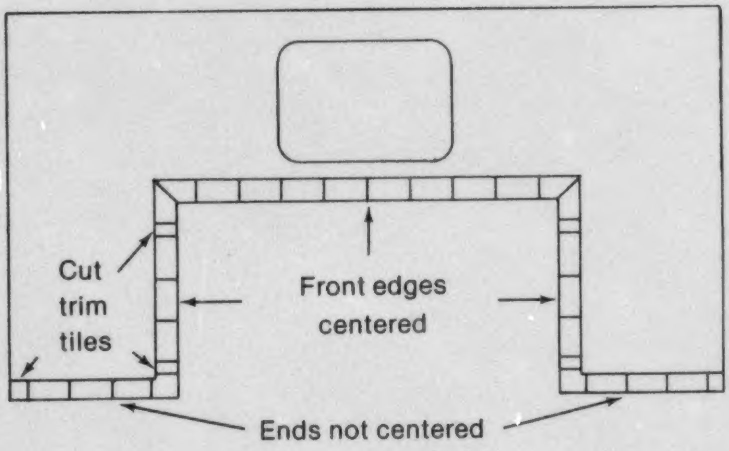
2) Adjust trim joints to center the trim between the corner pieces if possible

3) Cut filler tile if necessary

(NOTE: A filler tile is required if adjustment within allowable joint widths leaves space to be filled. Remember to allow for two joints when cutting the filler tile.)

JOB SHEET #1

FIGURE 7



   4. Trim tiles on open end of straight or L- or U-shaped counter top

      a. Align trim joints with field tile if trim and tile are same size; cut trim at wall if required

      b. Adjust trim tile joint width for tile and trim of different sizes; cut trim at wall if required

         (NOTE: Keep joint width as close to field tile joint width as possible.)

I. Use square to extend adjusted starting line to wall if required

   (NOTE: This should only be required for straight counter tops. Starting lines for L- or U-shaped counter tops should have been completed previously.)

J. Extend starting lines up wall if backsplash is to be installed; use level to plumb lines

K. Determine cuts at wall(s)

   1. Lay loose tiles along starting line(s) from front row to wall(s)

   2. Adjust joints if required to give maximum width of cuts at wall(s)

      (NOTE: Because full tiles are used in the front row, you will have little control over the width of the wall cut.)

   3. Allow for joint between wall and tile field for elastomeric sealant during installation

JOB SHEET #1

L. Lay enough loose tile on counter top deck to allow you to evaluate the layout of the counter and backsplash

(NOTE: Layout should be functional and attractive with a minimum number of small cuts.)

M. Adjust if required

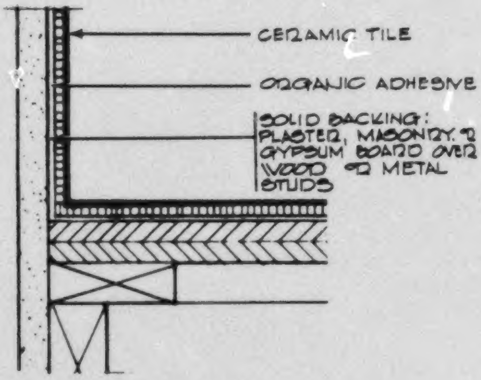
(NOTE: Get owner to approve layout if possible.)

COUNTER TOPS AND BACKSPLASHES
UNIT III

JOB SHEET #2 — INSTALL COUNTER TOP BACKSPLASH

I. Detail and guidelines from TCA *Handbook* (Figure 8)

FIGURE 8


CERAMIC TILE
ORGANIC ADHESIVE
SOLID BACKING: PLASTER, MASONRY OR GYPSUM BOARD OVER WOOD OR METAL STUDS

Recommended Uses:
- interiors over gypsum board, plaster, or other smooth surfaces.

Limitations:
- organic adhesives are not recommended in areas exposed to temperatures exceeding 140°F. Some backing materials may require lower temperatures.

Materials:
- organic adhesive — ANSI A136.1. Type I organic adhesive is recommended for tub and shower surrounds and Type II for intermittent water resistance.
- water resistant gypsum backing board ASTM C630. (Required in wet areas.)
- gypsum board — ASTM C36 (suitable for dry areas only).
- expansion joints (see Page 28).
- grout — specify type (see Pages 7 & 10).

Preparation by Other Trades:
- max. variation in the backing surface shall not exceed 1/8" in 8"-0" from the required plane.
- all gypsum board joints shall be treated with tape and joint compound bedding coat only (no finish coat).

Preparation by Tile Trade:
- seal surface of taped joints in water resistant gypsum backing board installations to prevent water damage.
- prime surface before applying adhesive when recommended by adhesive manufacturer.
- allow minimum of 24 hours after tile is set for solvent evaporation before grouting.

Installation Specifications:
- ANSI A108.4.

JOB SHEET #2

II. Tools and materials

A. Tools

1. Trowel (properly-notched trowel for type of tile)
2. Tile cutter
3. Sponges
4. Margin trowel
5. Rub brick (stone)
6. Tile saw
7. Nippers or rod saw
8. Rubber grouting trowel
9. Pails
10. Joint striking tool
11. Clean, dry cloths
12. Screwdriver
13. Gauging trowel
14. Steel tape or wood folding rule

B. Materials

1. Dry-set grout (desired color)
2. Latex additive
3. Elastomeric sealant
4. Organic adhesive
5. Tile
6. Trim pieces (type and amount estimated for job)
7. Source of clean, potable water

JOB SHEET #2

III. Procedure to prepare surface

A. Inspect surface to be tiled

1. Check to see that surface is dry, clean, free of oily or waxy films, and firm

2. Check to see that electrical, mechanical, and other work is installed; check especially at light switches and electrical outlets and leave covers off

3. Check to see that wall is plumb and level

(NOTE: Maximum allowable variation from the required plane for organic adhesive is $^1/_8$ inch in 8 feet. Refer to ANSI specifications and TCA guidelines.)

4. Check to see that corners are square with walls true to corners

B. Layout counter top and backsplash

(NOTE: It is recommended that the backsplash be installed first so that it is not necessary to work over the freshly tiled deck.)

IV. Procedure for installation

A. Carefully read directions on organic adhesive label

B. Apply primer to surface if required by organic adhesive manufacturer

C. Check open time for adhesive

(CAUTION: Temperature and humidity govern open time. Bond coat must remain wet to touch during installation.)

(CAUTION: If any areas film over during tile installation, remove the adhesive and apply a new coat.)

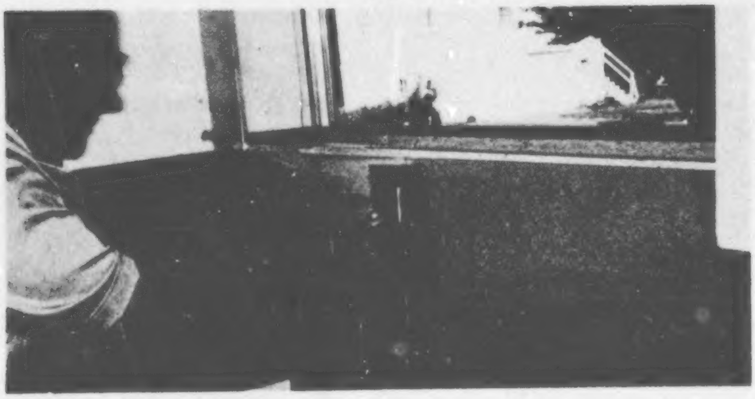
JOB SHEET #2

D. Spread adhesive up wall and then down from upper limit of field away from starting line with flat side of trowel to get a good mechanical bond (Figure 9)

(CAUTION: Do not apply any adhesive unless the proper notched trowel is available. Refer to ANSI specifications and TCA guidelines.)

(NOTE: Leave the starting line[s] exposed, as you will install tiles flush with the line[s].)

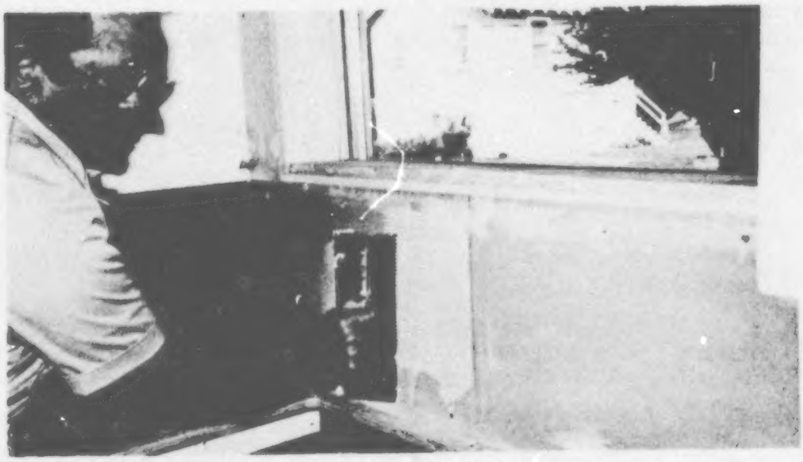
FIGURE 9



E. Apply additional adhesive and comb adhesive with the notched edge of trowel to get an even setting bed (Figure 10)

(CAUTION: After beat-in, there must be a minimum of 1/32" bond coat between the backup surface and back surface of the tile when using organic adhesive.)

FIGURE 10

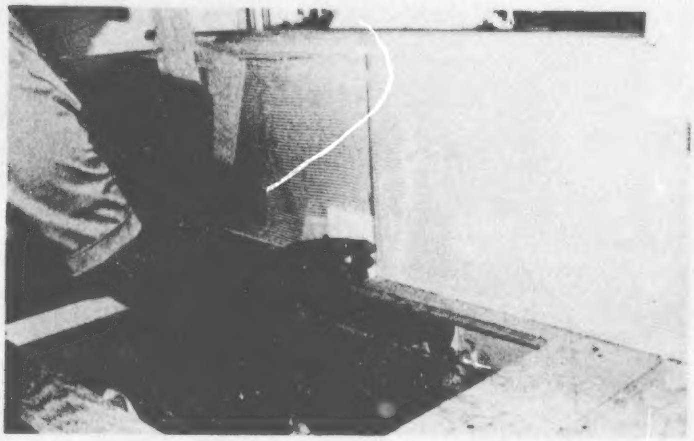


JOB SHEET #2

F. Install first tile at starting line, pressing firmly, twisting adhesive, and setting tile against counter top (Figure 11)

(CAUTION: Average contact area between bond coat and tile for dry area applications of organic adhesive should be at least 75 percent.)

FIGURE 11



G. Continue installing tile, making cuts as necessary, and beating in with rubber beating block

(NOTE: You should be able to make and install cuts on each section before organic adhesive films over.)

H. Install cut edges away from field

EXAMPLES: Toward cabinet bottom or window frame

I. Remove organic adhesive from tile surfaces with damp sponge

(NOTE: Follow manufacturer's instructions.)

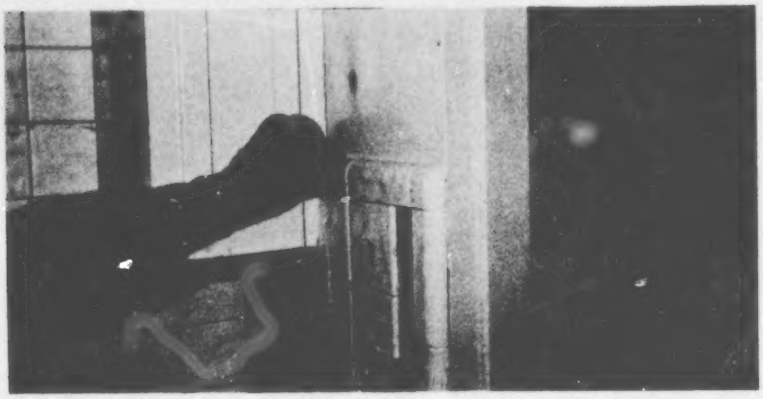
J. Continue installing and cleaning tile in small sections until backsplash is completed

JOB SHEET #2

K. Install trim over areas where the top row of tiles is exposed

(NOTE: An improved appearance can be obtained by continuing exposed areas of the field one full tile above adjoining cut rows and then trimming. See Figure 12.)

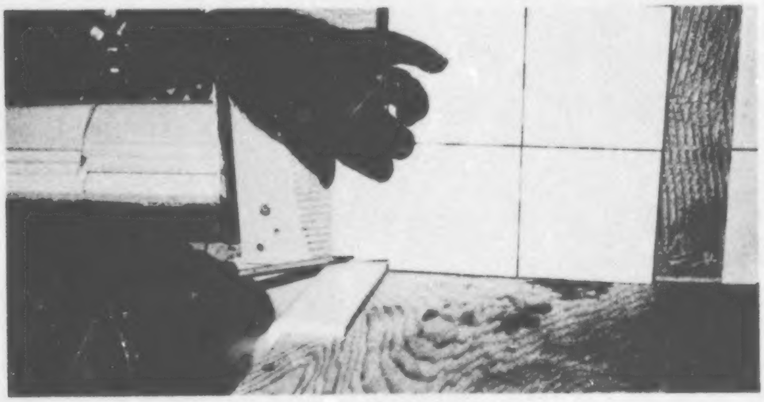
FIGURE 12



L. Set aside trim pieces that may require shaping until counter top installation is complete (Figure 13)

EXAMPLE:

FIGURE 13



M. Install vertical trim so that cuts are at the bottom of the row of trim; install horizontal trim so that cuts are at the back wall

N. Continue to clean adhesive from tile surfaces as you install tile and trim

(NOTE: Follow manufacturer's instructions.)

JOB SHEET #2

O. Install counter top tile if required

P. Clean tools and equipment

Q. Remove all waste from job site

R. Allow tiled area to cure for at least twenty-four hours before grouting

(CAUTION: Follow manufacturer's instructions for exact curing procedure.)

S. Grout and cure backsplash, and counter top if required

T. Clean tools and equipment

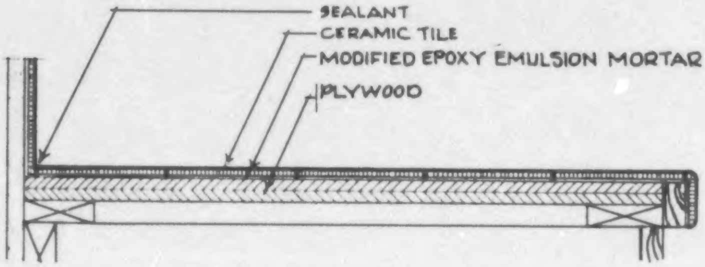
U. Remove all waste from job site

COUNTER TOPS AND BACKSPLASHES
UNIT III

JOB SHEET #3 — INSTALL CERAMIC TILE ON WOOD COUNTER TOP

I. Detail and guidelines from TCA *Handbook* (Figure 14)

FIGURE 14



COUNTER TOP

Recommended Uses:
- on counter tops where thin-set method is desired.

Requirements:
- ¾" exterior plywood base required
- the bottom edge of the counter top trim must be set the proper distance above the finish floor material to allow clearance for dishwashers, compactors, etc.

Materials:
- epoxy mortar — ANSI A118.3.
- organic adhesive — ANSI A136.1. Type I.
- Dry-Set or latex-portland cement mortar over glass mesh mortar units — (see page 6).
- modified epoxy emulsion mortar — (see page 5).
- grout — specify type (see Pages 7 & 10).

Preparation by Other Trades:
- when tile is set with epoxy leave ¼" gap between sheets of plywood. Apply batten to under side of sheets to cover gap.
- where overhangs or cantilever counters are used, adequate support must be provided to prevent movement.

Preparation by Tile Trade:
- when tile is set with epoxy completely fill gap between sheets of plywood with epoxy.
- protect plywood from exposure to water and high humidity.

Installation Specifications:
- adhesive — ANSI A108.4
- epoxy — ANSI A108.6
- Dry-Set or Latex-portland mortar — ANSI A108.5.

(NOTE: Detail and guidelines have been modified.

JOB SHEET #3

II. Tools and materials

A. Tools

1. Carbide nippers
2. Rub brick (stone)
3. Rubber grouting trowel
4. Beating block
5. Notched trowel (Proper notched trowel for type of tile)
6. Pails
7. Rubber mallet
8. Sponges
9. Tile cutter
10. Tile saw
11. Rod saw
12. Margin trowel
13. Steel square
14. Joint striking tool
15. Clean terry cloth towel
16. Gauging trowel
17. Rubber gloves

B. Materials

1. Dry-set grout (desired color)
2. Mortar or adhesive
3. Latex additive
4. Tile
5. Tile trim and angles
6. Elastomeric sealant
7. Source of clean, potable water

JOB SHEET #3

III. Procedure to prepare for installation

  A. Inspect counter top surface

    1. Check to see that deck is 3/4" exterior grade plywood and that front overhang is 1"

    2. Check to see that surface is dry, clean, free of oily or waxy films, and firm

    3. Check to see that surface is level

       (CAUTION: Maximum variation for counter tops using epoxy mortar is 1/8 inch in 10 feet. Refer to ANSI specifications and TCA guidelines.)

    4. If epoxy mortar is being used, check for 1/4 inch gap between sheets of plywood; check to see that batten boards are installed under gaps

    5. Seal edge and underside of plywood overhang with good water-resistant paint or sealer, especially in area adjacent to dishwasher installation

  B. Lay out area to be tiled

  C. Install backsplash if required

IV. Procedure for tile installation

  A. Place tiles and cap loosely on counter top and make all cuts according to layout

    1. Use the tile cutter to make all straight field cuts

       (NOTE: Cut counter top tiles adjoining backsplash 1/16" short to allow for sealant.)

    2. Use rod saw and nippers to make curved cuts

    3. Use tile saw to cut front edge cap and to miter inside angle

    4. Smooth cut edges with rub brick

    5. Check cap for proper clearance at dishwasher, compactor, or other appliance locations

  B. Put on rubber gloves

     (CAUTION: Always use rubber gloves when working with epoxy materials.)

     (NOTE: It is recommended that this job be done using modified epoxy emulsion mortar to allow practice with this material.)

JOB SHEET #3

C. Mix epoxy mortar

(CAUTION: Always follow manufacturer's directions exactly. Make sure epoxy has been properly stored prior to installation. Refer to ANSI specifications and TCA guidelines.)

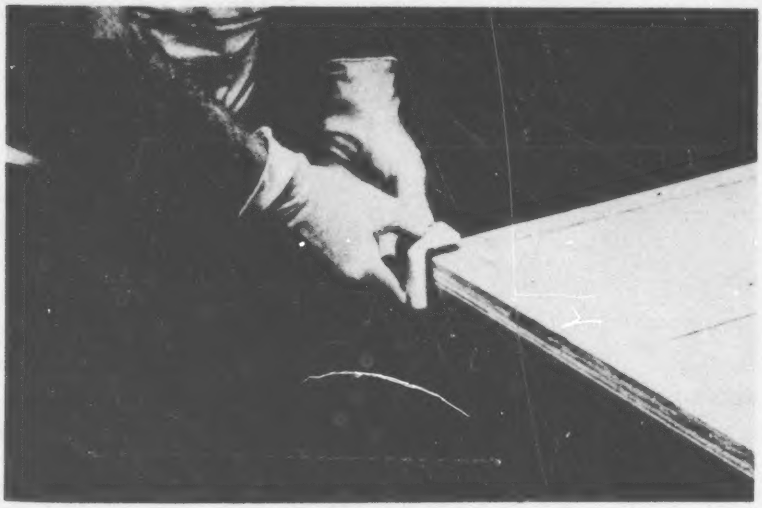
(CAUTION: Before mixing any mortar, be sure that the properly-notched trowel is available. Refer to ANSI specifications and TCA guidelines.)

D. Install trim pieces

1. Butter the back of front edge cap angles, if used, with epoxy

2. Press and twist each angle onto front edge, applying plenty of pressure to embed each piece firmly in epoxy (Figure 15)

FIGURE 15



3. Butter the other counter top trim pieces and cuts one at a time, and press and twist firmly into place

   (NOTE: If trim pieces contain no lugs, allow for proper joint width.)

4. Remove excess epoxy from counter top after cap is in place

   (CAUTION: Do not allow epoxy to harden on surface of tile or trim.)

JOB SHEET #3

E. Spread epoxy and install tile field

(CAUTION: Heat speeds up the epoxy setting process and reduces open time of epoxy mortars. Mortar must be plastic when tile is installed.)

1. Using flat side of notched trowel, put small amount of epoxy near starting line

   (NOTE: Leave starting line exposed, as you will install tiles flush with this line.)

2. Spread epoxy bond coat over first area to be tiled

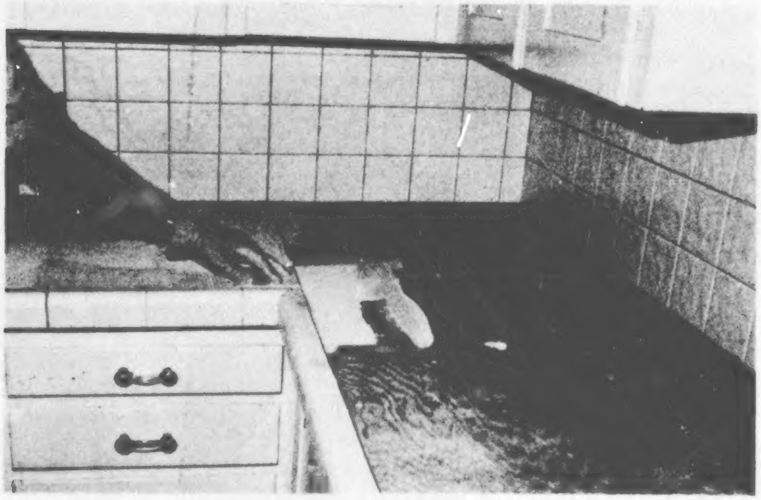
   (CAUTION: Completely fill gaps between sheets of plywood while applying mortar.)

3. Comb epoxy with notched edge of trowel to get an even setting bed

4. Install the first tile flush with starting line (Figure 16)

   (NOTE: Be sure to use plenty of pressure on each tile, twisting and embedding it firmly into epoxy; but make sure that you do not move the cap.)

FIGURE 16



5. Continue spreading and installing the field in small sections toward back wall

6. Install cuts, smoothed edge toward backsplash, pressing firmly into place

JOB SHEET #3

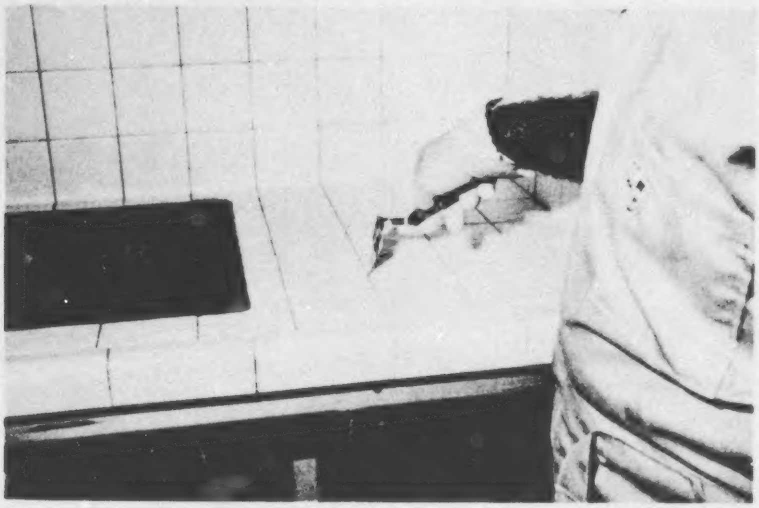
7. With beating block and hammer, beat tiles and cuts well into epoxy in a smooth, level plane

   (CAUTION: Average contact required between back of tiles and epoxy mortar bond coats is 100 percent for mosaic tile and 80 percent for other tiles.)

8. Align the joints with margin trowel, keeping the tile straight and removing excess epoxy from the joint (Figure 17)

   (NOTE: This ensures that not too much epoxy will be left in the joints, leaving no room for the grout.)

FIGURE 17



9. Using a damp sponge and clean water, go over entire tiled area, leaving it clean

10. Let tiled area cure for at least sixteen hours before grouting

11. Leave caution sign indicating that counter top is not to be touched while it is curing

12. Clean tools, remove all waste from premises, and leave surfaces (including floor) clean and clear of debris

F. Grout and cure tiled surface as required

G. Clean tools and remove all waste from work area

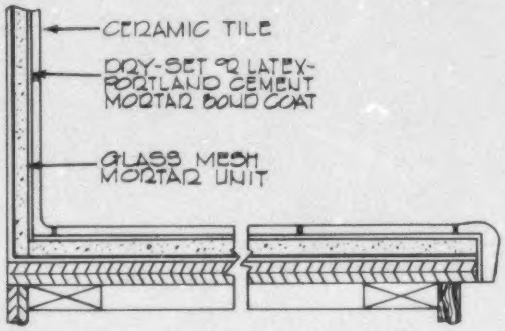
H. Double-check the job before you leave

COUNTER TOPS AND BACKSPLASHES
UNIT III

JOB SHEET #4 — INSTALL TILE OVER GLASS MESH MORTAR UNITS ON COUNTER TOP

I. Detail and guidelines from TCA *Handbook* (Figure 18)

FIGURE 18



Recommended Uses:
- on counter tops where thin-set method is desired.

Requirements:
- 3/4" exterior plywood base required
- the bottom edge of the counter top trim must be set the proper distance above the finish floor material to allow clearance for dishwashers, compactors, etc.

Materials:
- Dry-Set or latex-portland cement mortar over glass mesh mortar units — (see page 6).
- grout — specify type (see Pages 7 & 10).

Preparation by Other Trades:
- where overhangs or cantilever counters are used, adequate support must be provided to prevent movement.

Preparation by Tile Trade:
- completely fill 1/8"-3/16" gap between sheets of glass mesh mortar units with mortar, plywood with epoxy.
- protect plywood from exposure to water and high humidity.

Installation Specifications:
- Dry-Set or Latex-portland mortar — ANSI A108.5.

(NOTE: Detail and guidelines have been modified.)

JOB SHEET #4

II. Tools and materials

A. Tools

1. Margin trowel
2. Notched trowel (proper notched trowel for type of tile)
3. Nippers
4. Tile cutter
5. Floor-type, stiff rubber grouting trowel
6. Steel measuring tape or wood folding rule
7. Sponges
8. Pails
9. Pencil
10. Carbide-tipped scoring tool
11. Razor blade knife
12. Rod saw
13. Tile saw
14. Beating block
15. Rubber mallet
16. Nylon scouring pad
17. Claw hammer
18. Dustpan and counter brush
19. Clean terry cloth towels
20. Gauging trowel
21. Rub brick (stone)

B. Materials

1. Tile
2. Trim
3. Dry-set mortar (TCA-759 floor mix or TCA-763 wall mix)

JOB SHEET #4

4. Commercial portland cement grout

5. Glass mesh mortar units (7/16"; amount necessary to cover counter top and counter front edge)

6. Galvanized, screw-type roofing nails (1 1/4")

7. Fifteen-pound roofing felt or 4 mil polyethylene film

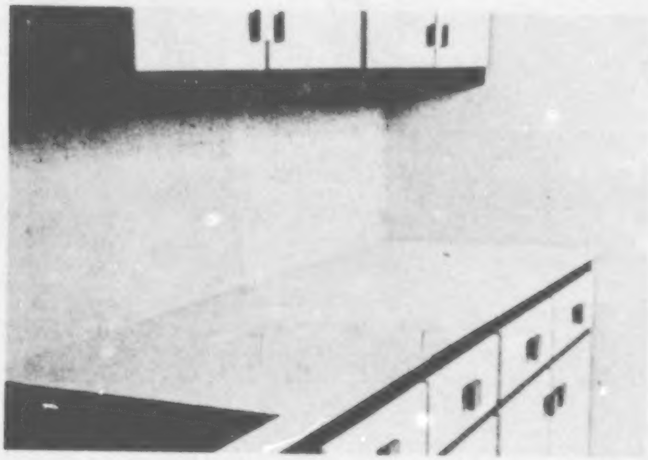
8. Latex additive

9. Source of clean, potable water

III. Procedure to prepare surface for installation

A. Check plywood counter base (Figure 19)

FIGURE 19



1. Check to see that top is sound 3/4" plywood and that front overhang is 1"

2. Nail loose places if necessary

3. Check joints and sand if necessary

4. Clean all dust from counter top

5. Seal edge and underside of plywood overhang with good water-resistant paint or sealer, especially in area adjacent to dishwasher installation

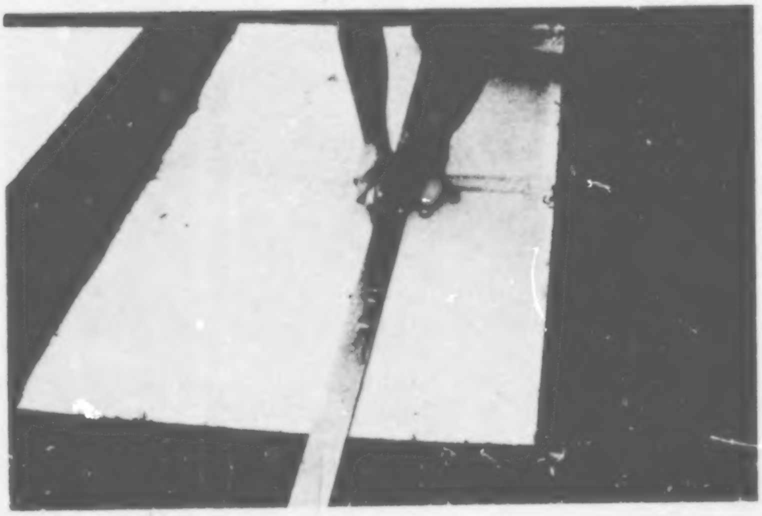
JOB SHEET #4

B. Install glass mesh mortar units to fit counter

1. Measure counter
2. Cut fifteen-pound roofing felt or 4 mil polyethylene film and place over entire top, allowing felt or film to hang over edge and down front of counter
3. Score and snap glass mesh mortar units to measured dimensions (Figure 20) and place on top of roofing felt, leaving 3/16" gap between units

   (NOTE: Gap will be filled solidly with mortar.)

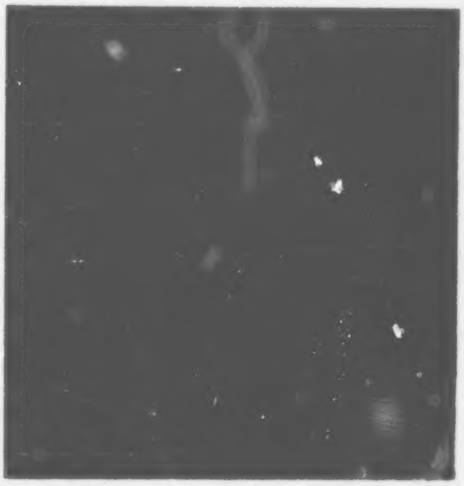
FIGURE 20



JOB SHEET #4

4. Nail glass mesh mortar units in place flush with edge of plywood, spacing 1 1/4" screw-type nails every six to eight inches along width and length of glass mesh mortar units (Figure 21)

FIGURE 21



5. Cut a strip of glass mesh mortar unit the width of counter front edge

6. Butter with mortar and laminate to edge of glass mesh mortar unit and felt paper or film which is folded down over edge of plywood

7. Nail glass mesh mortar unit to *plywood* edge at six to eight inch intervals with 1 1/4" nails

8. Clean all scraps, dust, and dirt, from installed glass mesh mortar units

   (NOTE: Leave excess felt paper or polyethylene film to protect cabinets until tile has been grouted.)

C. Lay out tile

D. Mix dry-set mortar

(CAUTION: Before mixing any mortar, make sure the proper notched trowel is available.)

1. Carefully follow manufacturer's instructions

2. In a five-gallon pail, mix dry-set mortar with latex additive

3. Let stand for approximately fifteen minutes

JOB SHEET #4

4. Remix

(CAUTION: Do not add additional powder or liquid.)

E. Check open time of mortar

(CAUTION: Temperature and humidity govern open time. Bond coat must be wet to touch at time of installation.)

F. With flat side of trowel, fill the 3/16" gaps between sections of glass mesh mortar units

(NOTE: Gaps must be filled solidly with mortar.)

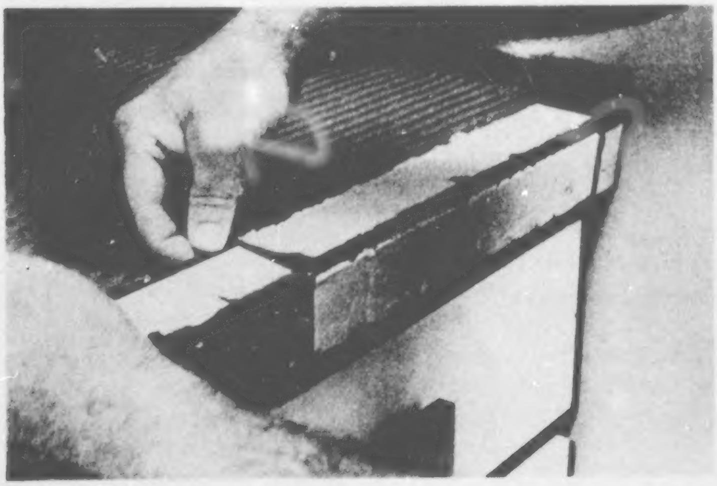
G. Use smooth side of trowel to spread mortar about 1/8" thick along front edge of counter; comb with notched edge of trowel

H. Press front edge of trim into mortar ribs on top surface

(NOTE: If V cap trim is used, butter each piece to provide full coverage with no voids. Press and beat into place.)

I. If bullnose trim is used, adjust both trim strips so that front edge of bullnose is flush with front surface of edge trim tile (Figure 22)

FIGURE 22



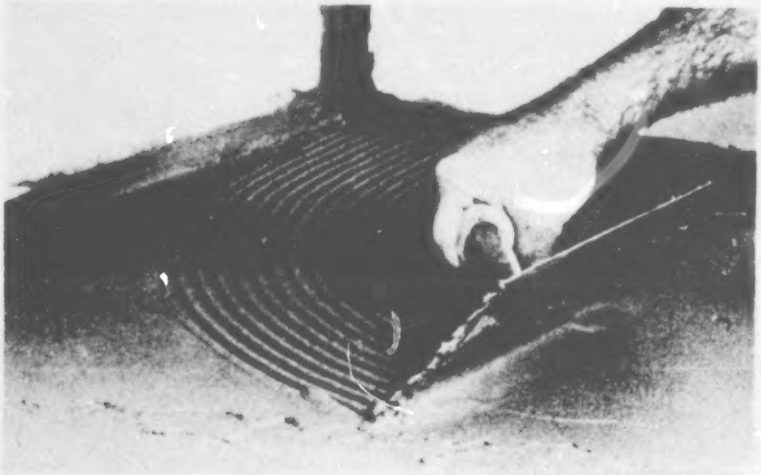
J. Using the flat side of the trowel, spread mortar on surface of glass mesh mortar unit away from starting line to get a good mechanical bond

JOB SHEET #4

K. Comb with the notched side of the trowel to get an even setting bed (Figure 23)

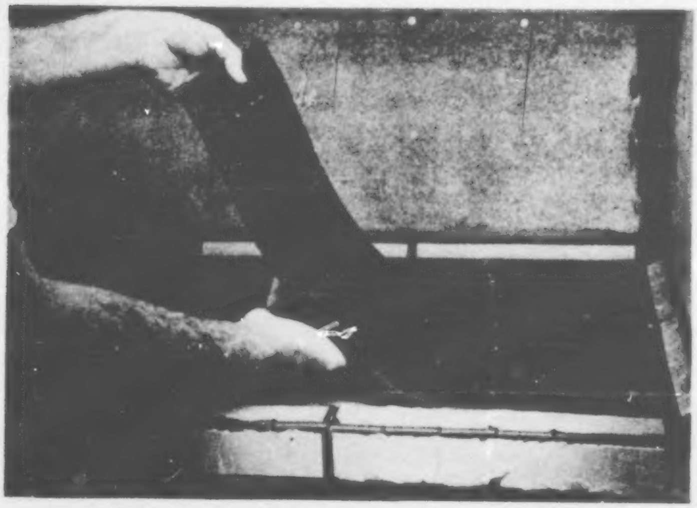
(CAUTION: Average coverage for contact between back of tile and bond coat is 80 percent when using latex-portland cement mortar. Finished mortar bed thickness after beat-in should be $^3/_{32}$ to $^1/_8$ inch. Refer to ANSI specifications and TCA guidelines.)

FIGURE 23



L. Install tile on top of combed mortar (Figure 24)

FIGURE 24



JOB SHEET #4

M. Clean tools and job site; remove all waste

N. Allow at least 48 hours before grouting

O. Grout and cure tile as required

P. Clean tools and job site; remove all waste

(Figures 21-24 courtesy American Olean Tile Company)

COUNTER TOPS AND BACKSPLASHES
UNIT III

JOB SHEET #5 — GROUT AND CURE COUNTER TOP AND BACKSPLASH

I. Guidelines from TCA *Handbook* (Figure 25)

FIGURE 25

GROUT SPECIFICATION GUIDE

Printed through the courtesy of the Materials & Methods Standards Association. A rubber faced trowel should be used when grouting glazed tile with sanded grout.		**GROUT TYPE** See p. 7 for complete description								
		Commercial Portland Cement		**Sand-Portland Cement**	**Dry-Set**	**Latex Portland Cement** (3)	**Mastic** (3)	**Epoxy** (1) (6)	**Furan** (1) (6)	**Silicone or Urethane** (2)
		Wall Use	**Floor Use**	**Wall-Floor Use**	**Wall-Floor Use**					
TILE TYPE	GLAZED WALL TILE (More than 7% absorption)	●			●	●	●			●
	CERAMIC MOSAICS	●	●	●	●	●		●		●
	QUARRY, PAVER & PACKING HOUSE TILE	●	●	●		●		●	●	
AREAS OF USE	Dry and intermittently wet areas	●	●	●	●	●	●	●	●	●
	Areas subject to prolonged wetting	●	●	●	●	●		●	●	●
	Exteriors	●	●	●	●	● (4)		● (4)	● (4)	
PERFORMANCE	Stain Resistance (5)	D	C	E	D	B	A	A	A	A
	Crack Resistance (5)	D	D	E	D	C	C	B	C	A Flexible
	Colorability (5)	B	B	C	B	B	A	B	Black Only	Restricted

(1) Mainly used for chemical resistant properties.
(2) Special tools needed for proper application. Silicone, urethane and modified polyvinylchloride used in pregrouted ceramic tile sheets. Silicone grout should not be used on kitchen countertops or other food preparation surfaces unless it meets the requirements of FDA Regulation No. 21, CFE 177.2600.
(3) Special cleaning procedures and materials recommended.
(4) Follow manufacturer's directions.
(5) Five performance ratings — Best to Minimal (A B C D E).
(6) Epoxies are recommended for prolonged temperatures up to 140°F, high temperature resistant epoxies and furans up to 350°F.

JOB SHEET #5

II. Tools and materials

- A. Margin trowel
- B. Gauging trowel
- C. Sponges
- D. Pails
- E. Nylon scouring pad
- F. Joint striking tool
- G. Grout
- H. Latex additive, if desired
- I. Source of clean, potable water
- J. Clean terry cloth towel
- K. Elastomeric sealant
- L. Rubber grouting trowel

III. Procedure for grouting

- A. Ensure that tiled areas have properly cured prior to grouting

  (NOTE: Remove spacers, if used, before grouting.)

- B. Mix required grout
  - 1. Follow manufacturer's instructions exactly
  - 2. If using grout with latex additive, use eight-quart pail
    - a. Stir vigorously with margin trowel
    - b. Mix to smooth, no-slump consistency
    - c. Let stand for approximately fifteen minutes
    - d. Remix

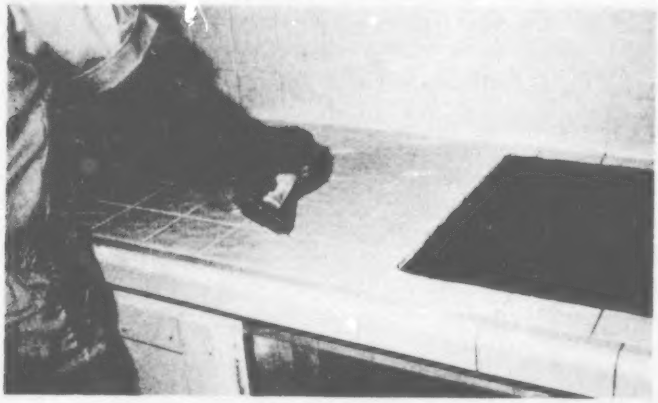
      (CAUTION: Do not add additional powder or liquid.)

JOB SHEET #5

C. Grout backsplash

1. Place small amount of grout on surface to be grouted using rubber grouting trowel (Figure 26)

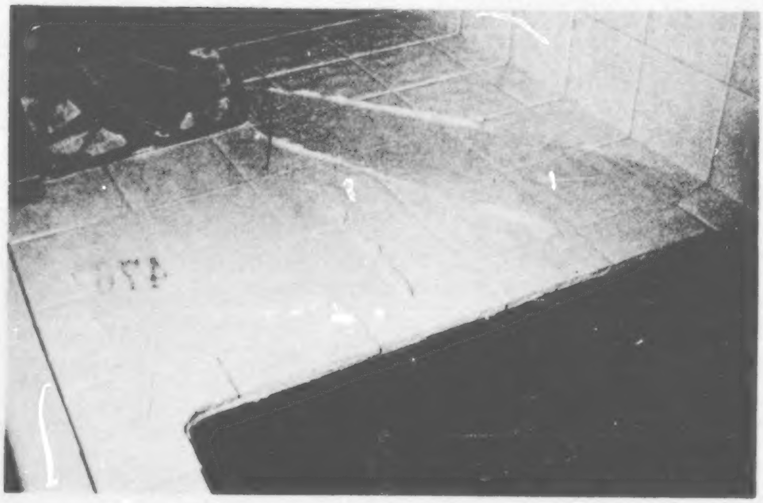
FIGURE 26



2. Force grout firmly into tile joints, using pressure on grouting trowel and moving in several directions to make sure all joints are well filled (Figure 27)

(CAUTION: Fill all gaps and skips. Do not permit mortar to show through grouted joints.)

FIGURE 27



JOB SHEET #5

3. Clean excess grout from tiled surfaces by moving rubber grouting trowel diagonally across joints and tile surfaces

(CAUTION: Do not allow grout to harden on face of tile.)

D. Strike grout joints if 1/8" wide or less

(CAUTION: Finished grout should be uniform in color, smooth and without voids, pin holes, or low spots. Clean the joints of cushion edge tile to depth of cushion. Fill joints of square edge tile flush with surface.)

E. Clean excess grout from tiled surface with damp sponge, rinsing frequently in clean water

F. If haze appears as tile dries, remove haze immediately with clean, dry terry cloth towel

G. Repeat procedure to grout counter top

H. Fill joint between deck and wall with elastomeric sealant

I. Clean tools and work area; remove all waste from area

J. Damp cure tiled area for at least seventy-two hours before allowing use

COUNTER TOPS AND BACKSPLASHES
UNIT III

TEST

NAME ______________________________________ SCORE ________________

1. Match to their correct definitions the terms on the right associated with counter top and backsplash tile installation.

______a. To spread a bond coat on back of a ceramic tile just before tile is installed

______b. Anything not reusable left over from tile installation job

______c. Cloudy film that may appear on tiles after grouting

______d. Squared line where tile is to start

______e. Top surface of counter top

______f. Material used to adhere the back of a ceramic tile to a prepared surface

______g. To bond or press together in layers

______h. Wall area behind and sometimes at end(s) of counter top

______i. Cut tile used to fill in a run of tile in the field; sometimes called a "dutchman"

1. Backsplash
2. Bond coat
3. Butter
4. Deck
5. Filler
6. Haze
7. Laminate
8. Starting line
9. Waste

2. Select from a list guidelines for counter top lay out. Place an "X" beside each correct guideline in the list below.

______a. Experiment until you have a layout with as few small cuts as possible

______b. Begin layout in back corner where walls meet to ensure square installation

______c. If at all possible, center entire layout at most conspicuous area

______d. Begin with full tile at cap if possible

______e. Use full tile on each side of sink or appliance cut outs

______f. Square starting lines and compensate for out-of-square deck at back wall cut

TEST

_____g. If backsplash is to be installed, allow for backsplash tile thickness plus joint at back wall

_____h. Double-check all calculations and measurements

_____i. Use backsplash layout to determine joints in deck

_____j. Show owner proposed layout before installing tile, if possible

3. Select from a list guidelines for installing counter tops and backsplashes.

_____a. Read and follow directions on work order carefully

_____b. Check area carefully for holes and uneven places

_____c. Be sure that counter top is ¾" interior grade plywood

_____d. Accurately measure area for tile layout

_____e. Leave wide joints to allow for expansion on areas near heat-producing appliances

_____f. Avoid using tile cutter or making cuts on tiled area

_____g. Avoid putting pressure on newly installed tile

_____h. Keep tile joints straight and of even width

_____i. Reduce amount of water used in grout on backsplashes to avoid runny appearance

_____j. Ensure that all nail heads are covered with elastomeric sealant prior to installing backsplash

_____k. Follow manufacturer's directions carefully with each product

_____l. Clean all surfaces as you go

_____m. Install counter top before backsplash to ensure proper alignment of joints

(NOTE: Test questions 4, 5, and 6 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

4. Interpret ANSI specifications and TCA guidelines for counter top and backsplash tile installations.

5. Interpret labels from products used in counter top and backsplash tile installations.

TEST

6. Demonstrate the ability to

   a. Lay out counter top and backsplash.

   b. Install counter top backsplash.

   c. Install ceramic tile on wood counter top.

   d. Install ceramic tile over glass mesh mortar units on counter top.

   e. Grout and cure counter top and backsplash.

COUNTER TOPS AND BACKSPLASHES
UNIT III

ANSWERS TO TEST

1. a. 3 f. 2
   b. 9 g. 7
   c. 6 h. 1
   d. 8 i. 5
   e. 4

2. a, c, d, f, g, h, j

3. a, b, d, f, g, h, k, l

4. Evaluated to the satisfaction of the instructor

5. Evaluated to the satisfaction of the instructor

6. Performance skills evaluated to the satisfaction of the instructor

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to install tile on wet area walls, floors, and ceilings. The student should also be able to install basic accessories used on wet area walls. This knowledge will be shown by completing assignment sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with wet area wall, floor, and ceiling tile installations.
2. Name examples of normal residential wet area installations.
3. Name types of ceramic bathroom accessories.
4. Interpret ANSI specifications and TCA guidelines for wet area wall, floor, and ceiling tile installations.
5. Interpret labels from products used in wet area wall, floor, and ceiling tile installations.
6. Demonstrate the ability to
    a. Install glass mesh mortar units in a tub surround.
    b. Install glass mesh mortar units in a shower.
    c. Prepare shower floor for tile installation.
    d. Build a shower curb.
    e. Lay out tub surround.
    f. Lay out shower.
    g. Install a tub surround.
    h. Install tile in shower stall.
    i. Grout wet area installation.
    j. Install fixtures.

OBJECTIVE SHEET

k. Install shower door.

l. Install tub enclosure doors.

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order materials planned to supplement unit.

1. Request from manufacturing and distributing companies labels, empty tile product bags, and materials.
2. *American National Standard Specifications for the Installation of Ceramic Tile, A-108* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.
3. *Handbook for Ceramic Tile Installation.* Current edition available from Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.
4. *American National Standard Specifications for Ceramic Tile.* Current edition available from ANSI, 1430 Broadway, New York, New York 10018.
5. Materials & Methods Standards Association (MMSA) *Bulletins.* Available from MMSA in care of H.B. Fuller Company, 315 South Hicks Road, Palatine, Illinois 60067.
6. Ceramic Tile Institute (CTI) *Field Reports.* Available from Ceramic Tile Institute, 700 North Virgil Avenue, Los Angeles, California 90029.
7. ASTM F-446-78 "Grab Bars and Accessories Installed in Bathing Area."
8. *Tilesetting Workbook.* Sacramento: California State Department of Education, 1975.
9. Current trade magazines and newsletters, such as *Tile and Decorative Surfaces.*

B. Provide students with objective sheet.

C. Discuss unit and specific objectives.

D. Provide students with information, assignment, and job sheets.

E. Discuss information and assignment sheets.

F. Show students the wide variety of designs possible with tile installations, especially on shower walls, floors, and ceilings.

SUGGESTED ACTIVITIES

G. Provide a wide variety of products and/or their labels for students to complete Assignment Sheet #2.

(NOTE: Assist students in associating specific brand names with the generic material.)

H. Stress the importance of matching appropriate materials with specific types of tile installation and the consequences of using the wrong materials. Stress the importance of checking manufacturer's shade numbers.

I. Remind students that answers to the following questions will help them select the proper materials and methods of installation. No job should start without favorable answers to these questions, resolved and agreed upon by all parties concerned.

1. Is the installation to be interior or exterior?
2. If interior, will it be in a wet or dry area, wall, floor, or ceiling?
3. If exterior, is there a potential danger of frost damage?
4. Is the tile selected suitable for this type of installation?
5. Is the backing suitable for this type of installation?
6. Are the selected installation materials and methods suitable for both the tile and backup surface?
7. Are the job conditions compatible with the installation specifications?

J. Demonstrate and discuss procedures outlined in job sheets.

(NOTE: Prepare mock-ups or arrange job sites for the students to use in accomplishing job sheets. You may consider using damp sand to form the shower floor in a mock-up.)

K. Give test after students complete unit and assignments.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

SUGGESTED ACTIVITIES

D. Assignment sheets

  1. Assignment Sheet #1 — Interpret ANSI Specifications and TCA Guidelines for Wet Area Wall, Floor, and Ceiling Tile Installations
  2. Assignment Sheet #2 — Interpret Labels from Products Used in Wet Area Wall, Floor, and Ceiling Tile Installations

E. Answers to assignment sheets

F. Job sheets

  1. Job Sheet #1 — Install Glass Mesh Mortar Units in a Tub Surround
  2. Job Sheet #2 - Install Glass Mesh Mortar Units in a Shower
  3. Job Sheet #3 — Prepare Shower Floor for Tile Installation
  4. Job Sheet #4 — Build a Shower Curb
  5. Job Sheet #5 — Lay Out Tub Surround
  6. Job Sheet #6 — Lay Out Shower
  7. Job Sheet #7 — Install a Tub Surround
  8. Job Sheet #8 — Install Tile in Shower Stall
  9. Job Sheet #9 — Grout Wet Area Installation
  10. Job Sheet #10 — Install Fixtures
  11. Job Sheet #11 — Install Shower Door
  12. Job Sheet #12 — Install Tub Enclosure Doors

G. Test

H. Answers to test

III. Unit references

  A. *American National Standard Specifications for Ceramic Tile A-137.1.* New York: ANSI, 1980.

  B. *American National Standard Specifications for the Installation of Ceramic Tile A-108.* New York: ANSI, 1976.

SUGGESTED ACTIVITIES

- C. *Ceramic Tile Manual.* Los Angeles, California: Building News, Inc., 1979.
- D. *Ceramic Tile Shapes and Sizes.* Princeton, New Jersey: Tile Council of America, Inc., 1958.
- E. *1982 Handbook for Ceramic Tile Installation.* Princeton, New Jersey: Tile Council of America, Inc., 1981.
- F. *Recommended Specifications for the Application and Finishing of Gypsum Board.* Evanston, Illinois: Gypsum Association, 1982.
- G. *Tilesetting Workbook.* Sacramento, California: State Department of Education, 1975.

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Backing — Surface to receive ceramic tile

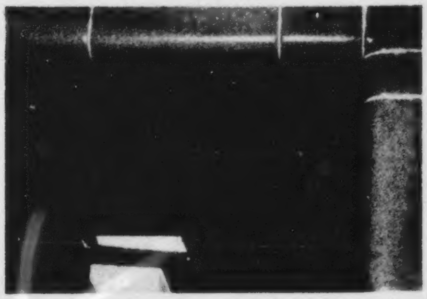
EXAMPLES: Water-resistant gypsum backing board, glass mesh mortar unit

B. Bond coat — Material used to adhere the back of a ceramic tile to a prepared surface

C. Broken joint — Laying of tile half off center (Figure 1)

EXAMPLE:

FIGURE 1



D. Butter — To spread a bond coat on back of a ceramic tile just before tile is placed

E. Diagonal joint — Laying tile at a forty-five degree angle (Figure 2)

FIGURE 2

INFORMATION SHEET

F. Metal lath — Mesh which acts as a background and reinforcing agent for the scratch or mortar coat

G. Screed — Strip of wood, metal, mortar, or other material applied to a surface; used as guide on which a straightedge is worked to obtain a true mortar surface

H. Sealant — Elastomeric material used to fill and seal joints; prevents passage of moisture and allows horizontal and lateral movement at joint

I. Skim coat — Thin coat of setting material applied with flat side of trowel using pressure to get a good mechanical bond

J. Starting line — Squared line where tile is to start

K. Trim — Tile units of various shapes and sizes used to complete an installation of desired sanitary or architectural design

L. Tub surround — Two end walls and back wall surrounding tub; usually sixty inches high or covers area just above shower head

(NOTE: A tub surround is sometimes called a "tub splash.")

M. Waste — Anything not reusable left over from tile installation

EXAMPLES: Empty tile cartons, paper, small tile cuts, mixed grout, empty pails

N. Waterproof membrane — Material used to provide a positive waterproof floor over the substrate which is to receive a tile installation using a wire-reinforced mortar bed

II. Examples of normal residential wet area installations

A. Shower

B. Tub surround

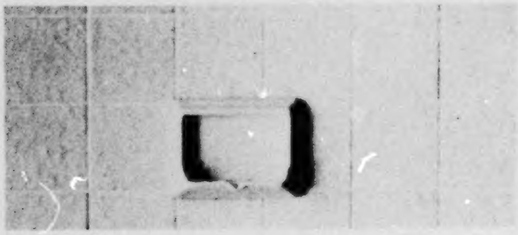
INFORMATION SHEET

III. Types of bathroom accessories (Figure 3-7)

A. Soap dish

EXAMPLE:

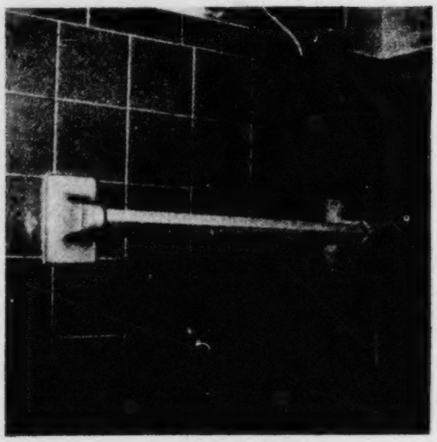
FIGURE 3



B. Towel bar

EXAMPLE:

FIGURE 4

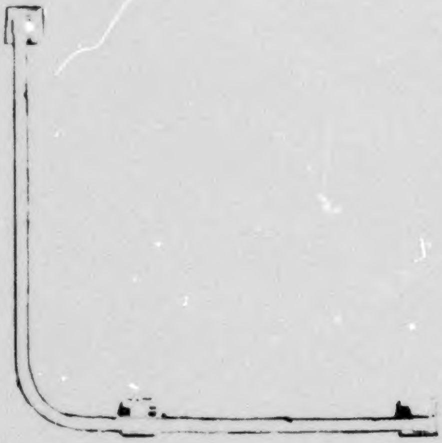


INFORMATION SHEET

C. Grab bar

EXAMPLE:

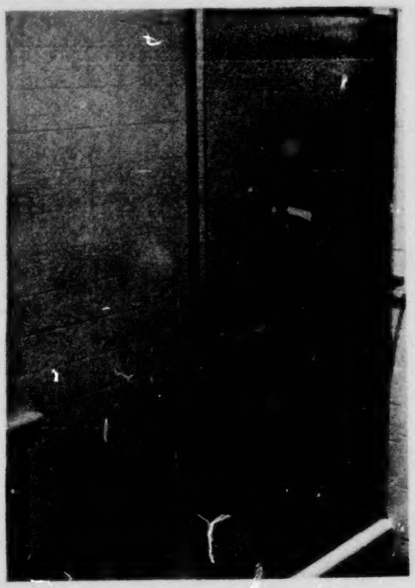
FIGURE 5



D. Tub enclosure

EXAMPLE:

FIGURE 6

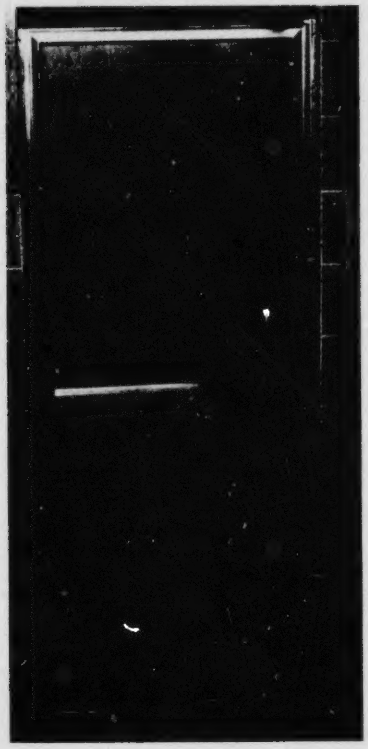


INFORMATION SHEET

E. Shower door

EXAMPLE:

FIGURE 7



WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

ASSIGNMENT SHEET #1 — INTERPRET ANSI SPECIFICATIONS AND TCA GUIDELINES FOR WET AREA TILE INSTALLATIONS

NAME ______________________ SCORE ____________

To properly install ceramic products using thin-set methods, the tile setter must know how to properly apply ANSI specifications and TCA guidelines. Practice in using these guidelines will improve your tile-setting skills and the quality of your work. This is especially important in areas designed for special conditions, such as frequent exposure to water.

Using *American National Standard Specifications for the Installation of Ceramic Tile* and *Handbook for Ceramic Tile Installation*, answer the following questions about wet area tile installations.

Part I — ANSI Specifications

A. What preparation is required of cuts and cutouts in water resistant gypsum backing prior to adhesive application? ______________________

____

____

(NOTE: This procedure may be performed by workers in another trade.)

B. When using organic adhesives, what distance is required between the paperbound edge of gypsum backing board and a tub or receptor lip? ______________________

C. What percent of coverage is required in showers using dry-set portland cement mortar to install 4 1/4" × 4 1/4" ceramic tile? ______________________

D. What mixture of portland cement mortar will be used for shower receptors?

____

____

____

E. Which is the better setting material choice for wet area installations over formed concrete, organic adhesive or latex-portland cement mortar mix? ______________________

____

____

ASSIGNMENT SHEET #1

PART II — TCA guidelines

A. What is the minimum thickness of gypsum board allowed as backing board in wet areas? ______

B. Is water-resistant gypsum board to be installed horizontally or vertically over tub and shower receptors? ______

C. What two methods are allowed in preparing the slope in a shower floor?

1. ______
2. ______

D. What treatment is required for joints in glass mesh mortar units for wall installations?

______

______

______

E. What is the maximum allowable spacing of wall studs in wet areas? ______

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

ASSIGNMENT SHEET #2 — INTERPRET LABELS FROM PRODUCTS USED IN SHOWER WALL, FLOOR, AND CEILING TILE INSTALLATIONS

NAME ______________________ SCORE ____________

Reading labels and following their directions are critical tasks in the success of a tile setter. Using products according to the manufacturer's directions is one key to completing tile installations that endure the test of time and are attractive.

Select from tile products used for thin-set installation of interior walls and ceilings. At least one example of each of the following tile products should be used to complete the label information sheets: elastomeric sealant, latex additive, grout, thin-set mortar, and waterproof membrane.

(NOTE: The application of some products used in thin-set tile installations remains basically the same for different types of jobs. However, some products used will vary greatly, depending on the specific installation. Using the wrong product during a tile installation can lead to failure.)

ASSIGNMENT SHEET #2

PART I — LABEL INFORMATION

A. Type of product **Elastomeric Sealant**

B. Brand name ____________________

C. Manufacturer's name and address ____________________

D. Directions for use (amount to use and how to use) ____________________

E. Surfaces on which product can be used ____________________

F. Surfaces on which produce should not be used ____________________

G. Caution statements ____________________

H. Net contents ____________________

I. List of ingredients ____________________

CT - 211-B

ASSIGNMENT SHEET #2

PART II — LABEL INFORMATION

A. Type of product **Latex additive**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

ASSIGNMENT SHEET #2

PART III — LABEL INFORMATION

A. Type of product **Grout** ______________________________

B. Brand name ______________________________

____

C. Manufacturer's name and address ______________________________

____

____

D. Directions for use (amount to use and how to use) ______________________________

____

____

____

E. Surfaces on which product can be used ______________________________

____

F. Surfaces on which product should not be used ______________________________

____

G. Caution statements ______________________________

____

____

____

H. Net contents ______________________________

____

I. List of ingredients ______________________________

____

____

____

ASSIGNMENT SHEET #2

PART IV — LABEL INFORMATION

A. Type of product **Thin-set mortar**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

ASSIGNMENT SHEET #2

PART V — LABEL INFORMATION

A. Type of product **Waterproof membrane**

B. Brand name

C. Manufacturer's name and address

D. Directions for use (amount to use and how to use)

E. Surfaces on which product can be used

F. Surfaces on which product should not be used

G. Caution statements

H. Net contents

I. List of ingredients

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

(NOTE: The answers for this assignment sheet are taken from ANSI A-108-76 and the 1983 TCA *Handbook*. Answers may differ if another edition is used.)

PART I

A. Caulk and seal (AN-3.6.2)

B. 1/4" (A-4.2.1.2.2.1)

C. 100% (A-4.3.2.5.2)

D. 1-part portland cement and 4-parts damp sand by volume

E. Latex-portland cement mortar mix (AN-2.5.3.2)

PART II

A. 1/2" (B413-83)

B. Horizontally (B415-83)

C. 1. Cement mortar (B415-83)

   2. Preformed liners

D. 1/8" joints filled with mortar and covered with 2" glass fiber mesh tape embedded in a skim coat of mortar over joints and corners (W244-83)

E. 16" o.c. (p. 23)

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #1 — INSTALL GLASS MESH MORTAR UNITS IN A TUB SURROUND

I. Tools and materials

A. Tools

1. Wood chisel (1 1/2")
2. Cement chisel (1 1/2")
3. Carbide-tipped chisel (1/4")
4. Steel measuring tape or wood folding rule
5. Levels
6. Claw hammer
7. Carbide-tipped scoring tool
8. Steel square (2')
9. Cement trowel
10. Straightedge (5')
11. Pails
12. Gauging trowel

B. Materials

1. Glass mesh mortar units
2. Galvanized, screw-type roofing nails (1 1/2" minimum)
3. Coated fiberglass tape (2" wide)
4. Dry-set mortar or latex-portland cement mortar

JOB SHEET #1

II. Procedure

A. Inspect area prior to installation

1. Check to see that bathtub is level and properly secured
2. Check to see that wall studs are straight and solid

(CAUTION: Wall studs must be no more than 16" o.c.)

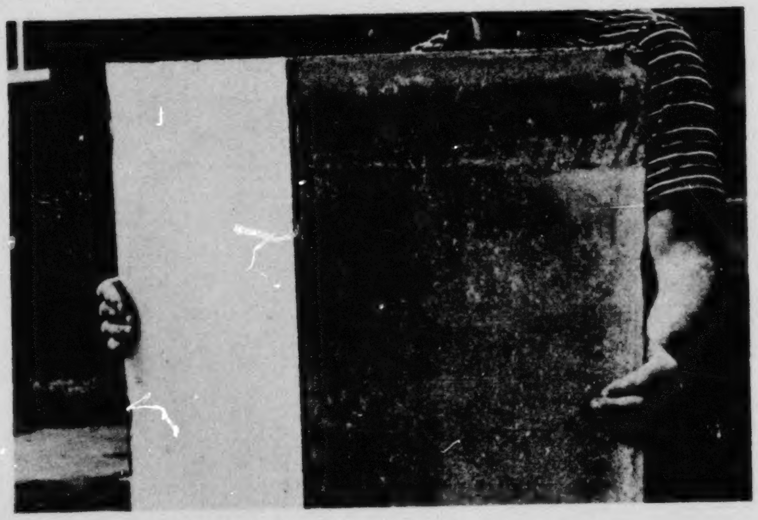
B. Mark stud locations on ceiling

C. Measure length of back wall

D. Transfer measurement to glass mesh mortar unit

E. Score glass mesh mortar unit along measured markings and snap (Figure 8)

FIGURE 8



F. Cut fiberglass mesh on back side

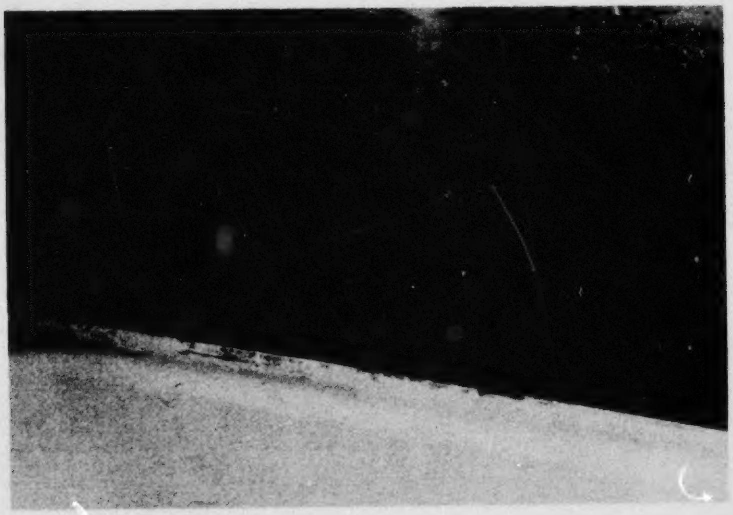
G. Use carbide-tipped chisel to cut out openings for recessed or semirecessed accessories, and water control fixtures as required during installation

JOB SHEET #1

H. Install first glass mesh mortar unit

1. Set glass mesh mortar unit on lip of tub (Figure 9)

FIGURE 9



JOB SHEET #1

2. Nail to studs at six- to eight-inch intervals

   (CAUTION: Hold nail firmly until nail has penetrated surface of glass mesh mortar unit.)

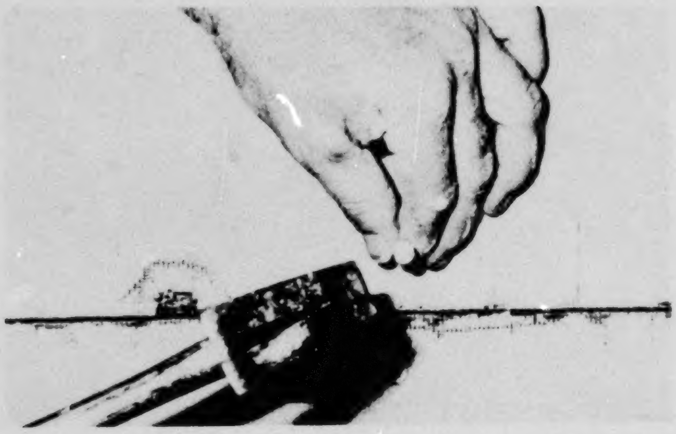
I. Cut and install second glass mesh mortar unit above first unit

1. Set with 1/8" to 3/16" gap between units

   (NOTE: Nails may be used to maintain gaps between glass mesh mortar units.)

2. Nail to studs at six- to eight-inch intervals (Figure 10)

FIGURE 10



J. Continue installation on back wall to required height

(NOTE: If installation continues to ceiling, leave 1/8" to 3/16" gap between glass mesh mortar unit and ceiling.)

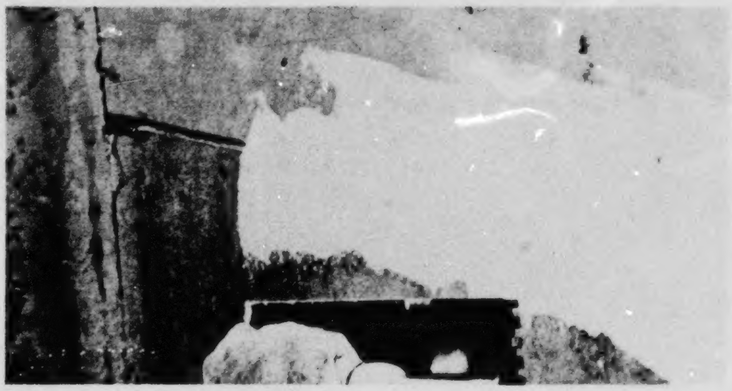
K. Cut and install glass mesh mortar units on end walls

1. Set glass mesh mortar units on lip of tub
2. Leave 1/8" to 3/16" gap between glass mesh mortar units at joints and corners
3. Nail at six- to eight-inch intervals

JOB SHEET #1

L. Completely fill all vertical, horizontal, and corner joints in glass mesh mortar units solid with mortar (Figure 11)

FIGURE 11



M. Embed two-inch wide, coated fiberglass tape in the mortar over all joints (Figure 12)

FIGURE 12

N. Smooth down mortared joints with cement trowel

(CAUTION: Tape must be embedded flush with face of glass mesh mortar units and finished flat and smooth.)

O. Clean up tools and work area or continue installation procedure

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #2 — INSTALL GLASS MESH MORTAR UNITS IN A SHOWER

I. Tools and materials

   A. Tools

      1. Wood chisel (1 1/2")
      2. Cement chisel (1/2")
      3. Carbide-tipped chisel (1/4")
      4. Steel measuring tape or wood folding rule
      5. Levels
      6. Claw hammer
      7. Carbide-tipped scoring tool
      8. Steel square (2′)
      9. Cement trowel
      10. Straightedge (5′)
      11. Pails
      12. Gauging trowel

   B. Materials

      1. Glass mesh mortar units
      2. Galvanized, screw-type roofing nails (1 1/2" minimum)
      3. Coated fiberglass tape (2" wide)
      4. Dry-set mortar or latex-portland cement mortar

II. Procedure

   A. Inspect area prior to installation

      1. Check to see that waterproof membrane is in place

      (CAUTION: Do not damage membrane during installation of glass mesh mortar units.)

JOB SHEET #2

2. Check to see that wall studs are straight and solid

   (CAUTION: Wall studs must be no more than 16" o.c.)

B. Install glass mesh mortar units on ceilings

1. Mark joist locations
2. Measure ceiling area
3. Transfer measurement to glass mesh mortar unit
4. Score glass mesh mortar unit along measured markings and snap
5. Cut fiberglass mesh on back side
6. Nail to ceiling joists at six- to eight-inch intervals

   (NOTE: This requires the aid of a helper.)

C. Install glass mesh mortar units on walls

1. Lay 2" × 4" board flat on waterproof membrane to prevent damage to membrane by glass mesh mortar unit (Figure 13)

FIGURE 13

2. Mark stud locations on ceiling
3. Measure wall and transfer measurement to glass mesh mortar unit

JOB SHEET #2

4. Score glass mesh mortar unit along measured markings and snap
5. Cut fiberglass mesh on back side
6. Place cut glass mesh mortar unit on 2" × 4" board and nail to studs at six- to eight-inch intervals

   (CAUTION: Do not nail below top of membrane.)

   (CAUTION: Hold nail firmly until nail has penetrated surface of glass mesh mortar unit.)
7. Remove 2" × 4" board
8. Install second glass mesh mortar unit above first
   - a. Measure, score, and snap
   - b. Leave 1/8" to 3/16" gap between units
   - c. Nail to studs at six- to eight-inch intervals
9. Continue to install glass mesh mortar units with 1/8" to 3/16" gaps between all vertical, horizontal, and corner joints
10. Repeat procedures for remaining walls and jambs
11. Use carbide-tipped chisel to cut out openings for water pipes and control valve as required
12. Completely fill all vertical, horizontal, and corner joints in glass mesh mortar units solid with mortar
13. Embed two-inch wide, coated fiberglass tape in the mortar over all joints
14. Smooth mortared joints with cement trowel

    (CAUTION: Tape must be embedded flush with face of glass mesh mortar units and finished flat and smooth.)

D. Clean up tools and work area or continue shower installation procedure

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #3 — PREPARE SHOWER FLOOR FOR TILE INSTALLATION

I. Tools and materials

A. Tools

1. Mortar box
2. Mortar hoe
3. Steel tape or wood folding rule
4. Pencil
5. Level
6. Cement trowel
7. Margin trowel
8. Gauging trowel
9. Drain plug to fit shower drain
10. Pails
11. Straightedges
12. Tin snips

B. Materials

1. Masonry sand
2. Portland cement (Type I)
3. Source of clean, potable water
4. Wire mesh
5. Several short, wooden straightedges
6. Gravel or tile chips

JOB SHEET #3

II. Procedure

(NOTE: Shower floor installation requires practice before the tile setter can do a proper job. Your instructor may have you practice this as a separate procedure.)

A. Mix screed mortar

1. Mix well three parts fine masonry sand and one part Type I portland cement

2. Add clean water until you get a no-slump mixture

   (NOTE: If you can squeeze the mortar into a ball and it stays firm without dripping water, it is ready to install.)

B. Determine the horizontal starting height for base

1. Adjust drain so that there is a minimum of 1¼" from membrane to top of drain

   (CAUTION: Drain should be sealed with rag or plug to prevent entry of foreign material. This requires removal of the strainer. Strainer may be replaced after the drain is plugged.)

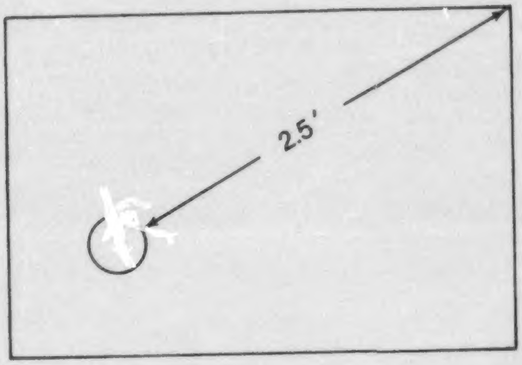
2. Measure distance from drain to wall at farthest point from drain (Figure 4)

3. Determine pitch of floor by multiplying number of feet to wall times desired slope

   (NOTE: The slope to the drain should be a minimum of ¼" to a maximum of ½" per foot.)

   EXAMPLE:

FIGURE 14



Distance from drain to farthest wall	2.5'
Times minimum slope	× .25"
Total slope (required height above drain)	.625"

JOB SHEET #3

4. Rest one end of level on top of drain and hold other end against shower wall

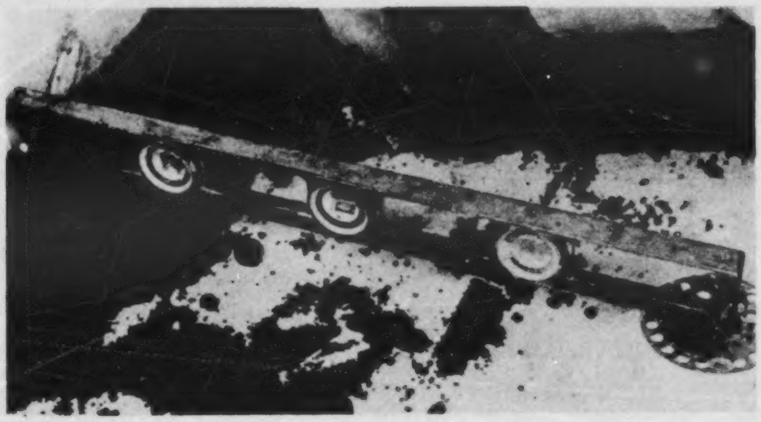
5. Place a mark on the wall at a point level with top of drain

6. Measure up from mark to the required height above drain and draw a second line

7. Build a spot of well-packed screed mortar to the height of the second mark less the thickness of the tile to be installed

8. Build a well-packed, level screed around entire perimeter of shower to the height of the screed spot (Figure 15)

FIGURE 15



C. Pack mortar up to required height about 1" wide along wall

(NOTE: If walls consist of glass mesh mortar units backing board, firmly pack mortar behind and under units with the back of a gauging trowel.)

(CAUTION: Do not damage membrane.)

D. Install and grout tile on shower walls and ceilings

(NOTE: See Job Sheets 7-10 for the required procedures.)

E. Remove cardboard or other membrane protective covering and remove drain

F. Install plug in drain below weep holes and add water to check for leaks.

(NOTE: If leak is detected, patch or repair membrane.)

JOB SHEET #3

G. Remove test plug and drain water

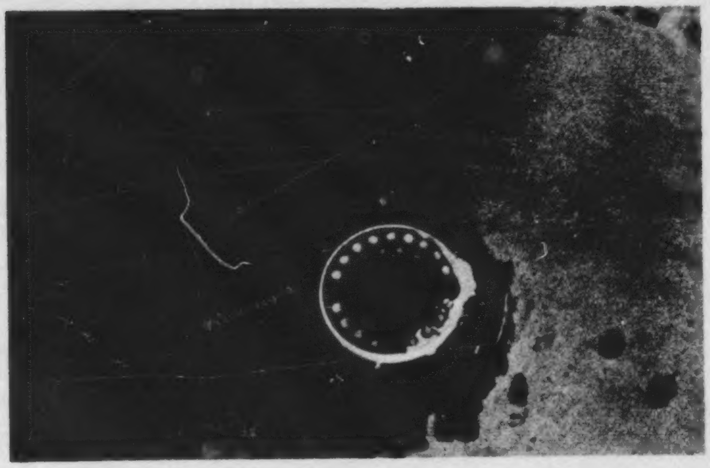
H. Reinstall drain and adjust to same height determined in Step B

I. Stuff rag in drain to prevent entry of foreign material

J. Place gravel or small chips of broken tile around drain at weep holes (Figure 16)

(NOTE: Gravel or tile chips must be of sufficient amount to keep mortar from plugging weep holes.)

FIGURE 16



K. Mix mortar for floor

1. Mix four parts damp sand and one part portland cement by volume in mortar mixing box

   (NOTE: Put sand in box first, then add cement.)

2. Mix with mortar mixing hoe, pulling mixture to one end of box and then pulling it back to the other end

3. Level out mixture and make small troughs in top to hold water

4. Add water slowly until very firm mix is obtained

   (CAUTION: This mix should be only of a damp consistency, so when well compacted and tamped no moisture appears on the surface.)

JOB SHEET #3

L. Carry mortar to shower in pails and dump on floor

M. Spread mortar to approximately half of depth needed, using cement trowel

N. Spread evenly and tamp and compact with trowel or beating block

O. Cut a piece of wire mesh slightly smaller than floor area; cut out area for drain

P. Place mesh on mortar bed and firmly embed

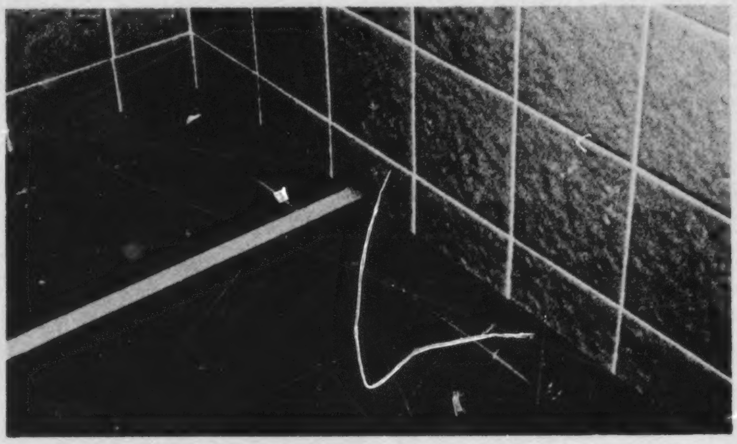
Q. Add mortar up to cove and top of drain

R. Spread evenly; tamp and compact thoroughly with trowel or beating block

S. Cut square notch the thickness of floor tile in a 6" to 8" piece of wood

T. Screed off mortar around tile base with notch on lip of cove base; screed off mortar around drain with notch on edge of drain (Figure 17)

FIGURE 17



U. Use proper length of straightedge to screed floor flat and smooth between the screeded areas at the walls and drain

(CAUTION: All mortar must be packed well, especially in corners and around drain. Surface must be smooth and flat with an even slope to drain.)

(NOTE: At this time, you may either continue the procedure to set floor tile or you may set the floor tile at a later time using dry-set mortar over the hardened, screeded surface. Clean up tools and work area if floor is to be allowed to harden.)

JOB SHEET #3

V. If tile is to be set immediately, sprinkle approximately 1/16" dry portland cement uniformly over surface of mortar

(NOTE: Cement will absorb moisture from mortar bed.)

(CAUTION: Never sprinkle mortar bed with dry-set mortar powder.)

W. Sprinkle a little water on surface if cement does not appear wet

X. Install floor tile

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #4 — BUILD A SHOWER CURB

I. Tools and materials

A. Tools

1. Mortar box
2. Mortar hoe
3. Shovel
4. Claw hammer
5. Tin snips
6. Margin trowel
7. Gauging trowel
8. Cement trowel
9. Straightedges
10. Level

B. Materials

1. Masonry sand
2. Portland cement (Type I)
3. Source of clean, potable water
4. Expanded metal lath (painted or galvanized, 3.4 lbs./sq. yd.)
5. Bricks
6. Felt paper (15#) or polyethylene film (4 mil)
7. Nails (assorted)
8. Form boards (at least 1" nominal thickness long enough to reach across shower door opening)
9. Hydrated lime

JOB SHEET #4

II. Procedure

(NOTE: It is recommended that you practice building a curb prior to building one as a part of a shower tile installation job.)

A. Fold membrane back away from area where you will be building curb

B. Prepare wood floor under curb if required

1. Place felt paper or polyethylene film over floor area where curb is to be built
2. Nail expanded, galvanized metal lath over felt paper or polyethylene film

C. Decide how many bricks are required to build curb to proper height

D. Mix mortar

1. Measure five shovelfuls of sand into mortar box
2. Spread sand evenly in box
3. Add one shovelful of portland cement and one-half shovelful of hydrated lime; spread evenly over top of sand
4. Pull mixture toward you with mortar hoe
5. Move to other end of mortar box and pull mixture toward you
6. Pull hoe through mixture several times from each end to thoroughly mix
7. Spread mixture evenly and then make small troughs across the mixture with the hoe
8. Add small amounts of water to the troughs
9. Use a chopping motion with the hoe to mix the water into the dry mixture; work from end to end
10. Repeat steps 7-9, adding water in small amounts, to produce a trowelable mixture

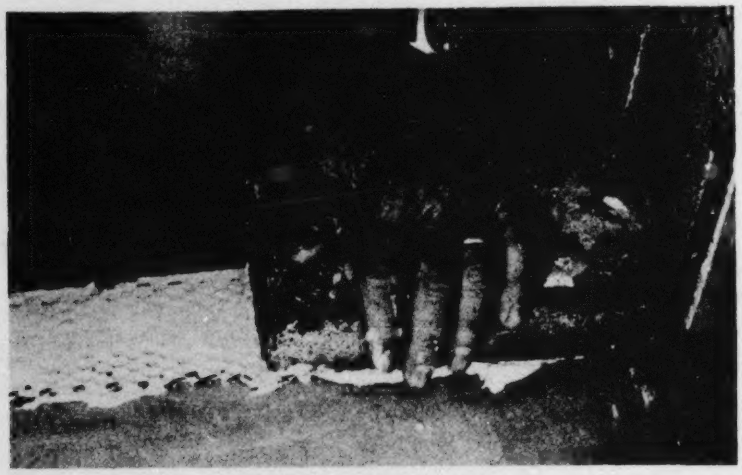
(NOTE: The mortar should be firm.)

E. Spread a layer of bed mortar about 1/2" thick the full length of curb between shower door jamb sides

JOB SHEET #4

F. Place first brick flat side down in mortar with the front side flush with outside wall; tap into place with trowel handle (Figure 18)

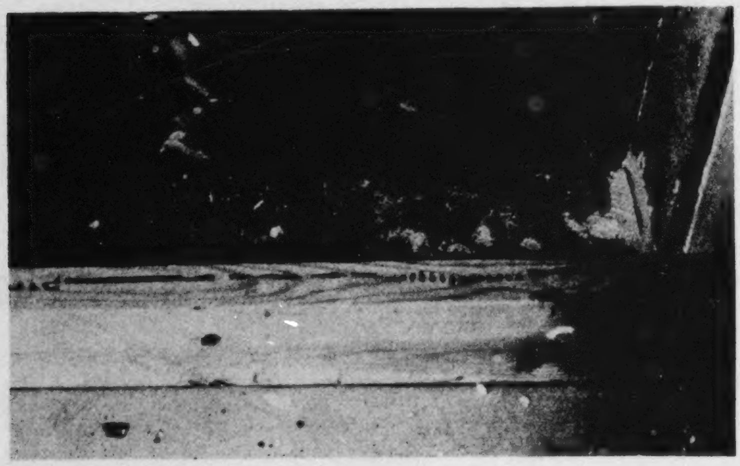
FIGURE 18



G. Spread mortar on end of next brick; press into bed mortar and twist to first brick leaving about 1/2" joint

(NOTE: Use straightedge to align bricks across openings. See Figure 19.)

FIGURE 19



JOB SHEET #4

H. Continue laying bricks in same manner to opposite shower door jamb

(NOTE: Last brick should be 1/2" short of shower door jamb to allow for joint. Spread mortar on both ends of last brick.)

I. Level bricks, using trowel handle to tap into mortar bed as necessary

J. Lay additional courses of bricks to rough curb height

(NOTE: Rough curb height should be at least 3/4" less than the desired finish height.)

K. Clean all excess mortar from face of bricks outside shower stall

L. Fold membrane up over the top of bricks flush with the outside edge of curb

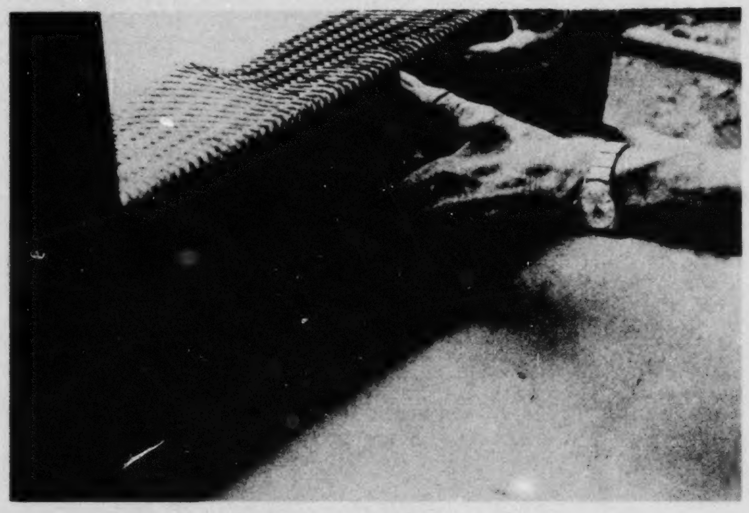
(CAUTION: Take care not to puncture or tear membrane.)

M. Use tin snips to cut a piece of expanded metal lath the length of the curb and wide enough to cover top and inside face of curb

(CAUTION: Avoid puncturing membrane with metal lath.)

N. Bend lath at a right angle to fit curb (Figure 20)

FIGURE 20



O. Lay lath on curb

P. Place mortar over lath on inside face and top of curb, forcing mortar into lath with trowel

JOB SHEET #4

Q. Smooth mortar flush with shower stall walls

1. Level and nail a straight board across outside face of curb at desired height of tile mortar bed

   (NOTE: If it is not possible to nail the board to the walls, use an assistant or some other means to hold the board in place.)

2. Working from inside shower, place a straight board level across inside face of curb approximately 3/16" lower than outside form board

   (CAUTION: Use care not to damage membrane.)

3. Spread and smooth mortar flush with two boards

   (NOTE: This will give you the required inward pitch on the top of the curb.)

4. Slide inside board back and forth and simultaneously ease it up carefully, maintaining contact with the shower walls to avoid distorting mortar

5. Remove outside board when mortar has set

R. Clean up tools and work area or continue shower installation procedure

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #5 — LAY OUT TUB SURROUND

I. Tools and materials

- A. Pencil
- B. Level
- C. Steel tape or wood folding rule
- D. Tile cutter
- E. Tile and trim for layout
- F. Protective pad for bathtub

II. Procedure to prepare area for layout

- A. Clean bottom of tub and cover with protective material if not previously done
- B. Determine and mark location of wall studs in all three walls
- C. Plan location of accessories and mark

  (NOTE: Check with owners for desired locations if possible.)

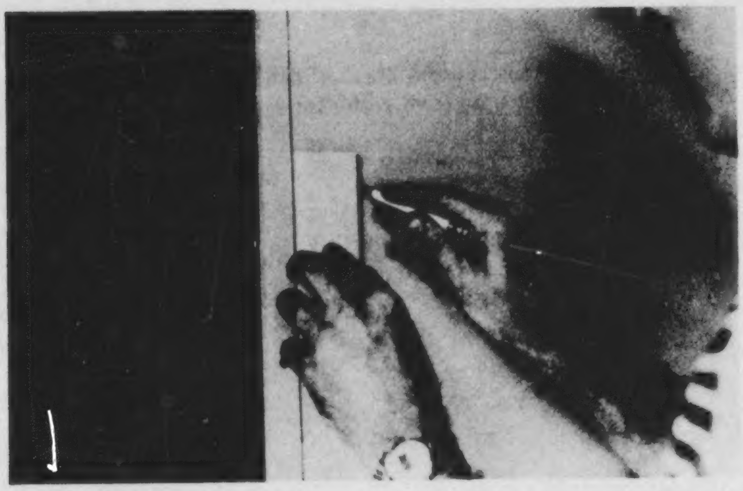
III. Procedure for layout

- A. Determine height of field plus trim; mark line 1/2" lower on all three walls
- B. Use level to draw horizontal lines at required height on all three walls
- C. Lay out end walls
  1. Begin in corner against back wall with full tile and loose lay tiles along end wall; allow for joints
  2. Continue lay out to full tile which extends beyond edge of tub

JOB SHEET #5

3. Place trim tile next to field tile and mark (Figure 1)

FIGURE 21



4. Measure ½" inside the mark and plumb a line from tub level to the horizontal line at top of tile field

5. Repeat procedure at other end wall

D. Determine starting line on back wall

1. Measure the back wall

2. Mark the middle of the back wall near the tub

3. Use loose tiles or rule to determine end cuts on back wall from the center point

4. Adjust tile layout

   a. Adjust joint width to eliminate cuts or to increase the size of end cuts if possible

      (NOTE: End cuts should be equal and wider than one-half tile.)

   b. Adjust starting point if joint width adjustment is inadequate to allow proper end cuts

JOB SHEET #5

5. Use level to draw plumb line from tub to top of field

   (NOTE: This is the starting line for the back wall.)

E. Check to see if tub is level

   1. If tub is more than 1/4" out of level, place a full tile at low point of tub allowing joint width for sealant
   2. Make a mark at top of tile and draw a level line around perimeter of field
   3. Cut first row of tiles to fit this line and number tiles

F. Install tiles

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #6 — LAY OUT SHOWER

I. Tools and materials

- A. Pencil
- B. Level
- C. Steel tape or wood folding rule
- D. Square

II. Procedure for wall layout

- A. Determine and mark location of wall studs at tops of walls
- B. Plan location of accessories and mark

  (NOTE: Check with owners for desired locations if possible.)
- C. Find center of one wall and mark with a short line
- D. Use ruler or loose lay tiles to determine ends cuts from starting mark
- E. Adjust tile layout
  1. Adjust joint width to eliminate cuts or to increase the size of end cuts if possible

     (NOTE: End cuts should be equal and greater than one-half tile.)
  2. Adjust starting point if joint width adjustment is inadequate to allow proper end cuts
  3. Draw plumb line from floor to ceiling at adjusted starting point
- F. Determine the horizontal starting line for the base and build screed mortar to required height

  (NOTE: This procedure is described in Job Sheet #3 — Prepare Shower Floor for Tile Installation.)

JOB SHEET #6

G. Determine vertical starting line for base tile if required

(NOTE: This is only required if the base tile length is different from the size of the field tile.)

1. Use ruler or trim tile to determine end cuts

2. Adjust trim layout

    a. Adjust joint width to eliminate cuts or to increase size of end cuts if possible

    (NOTE: End cuts should be equal and greater than one-half the length of the trim. Keep trim joint width as close to field tile joint width as possible.)

    b. Adjust starting point if joint width adjustment is inadequate to allow proper end cuts

    c. Mark starting point in screed

H. Repeat steps C-G for other walls

III. Procedure for ceiling lay out

(NOTE: It is recommended with thin-set methods that ceiling tile be set diagonally because other ceiling patterns may require adjustments for out-of-square conditions that are not possible with thin-set methods.)

A. Measure each wall

B. Mark center point of each wall

C. Draw lines connecting center points of opposite walls

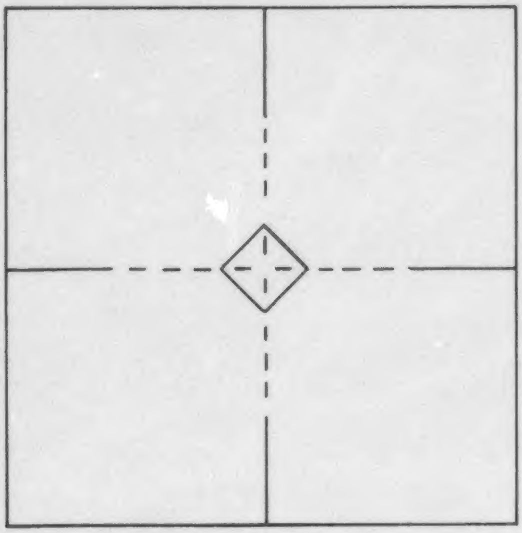
(NOTE: These lines should intersect at the approximate center of the ceiling.)

JOB SHEET #6

D. Determine diagonal layout to use

(NOTE: The most attractive diagonal layouts are centered in the middle of the ceiling as shown in Figures 22 and 23.)

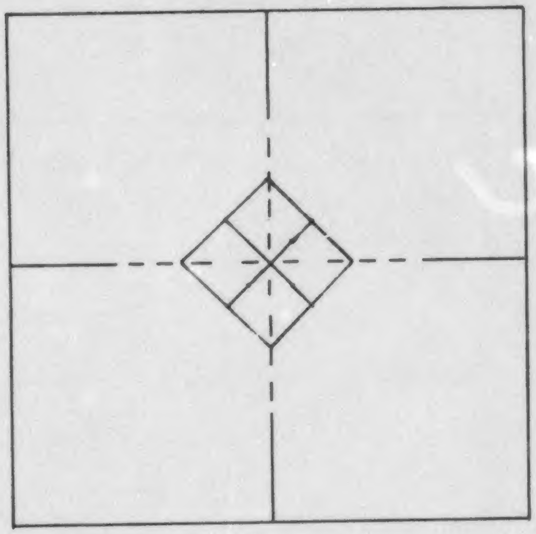
FIGURE 22



TILE-CENTERED LAYOUT

JOB SHEET #6

FIGURE 23



JOINT-CENTERED LAYOUT

1. Use loose tiles or measure to determine cuts at walls along center line using tile-centered layout and note size of cut

2. Determine cuts at walls along center line using joint-centered layout and note size of cut

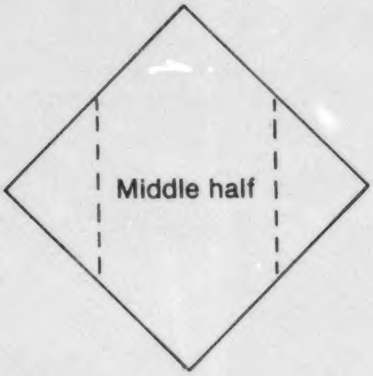
   (NOTE: If shower is rectangular, repeat steps 1 and 2 for the other center line.)

JOB SHEET #6

3. Compare size of wall cuts for each layout

   (NOTE: A good layout has a minimum number of small cuts. Ideally, the cut line should fall within the middle half of the diagonal distance. See Figure 24. The closer the cut is to the middle of the tile the more attractive the layout.)

FIGURE 24



4. Choose layout which results in the smallest number of small cuts or which produces the most attractive layout if cuts for each layout are acceptable

E. Determine starting line

1. Place a tile at the center of the ceiling in the required tile-centered or joint-centered position

   (NOTE: If light cutout prevents positioning tile in center of ceiling, measure along center line to determine an alternate tile location.)

2. Draw lines along adjoining sides of tile

   (NOTE: Be sure tile is correctly aligned with center lines.)

3. Check lines with square and lengthen

4. Use straightedge to extend lines to walls

   (NOTE: Set first tiles at intersection of starting lines.)

JOB SHEET #6

IV. Procedure for floor layout

(NOTE: The preferred material for shower floors using thin-set methods is sheet-mounted mosaic floor tile certified by the manufacturer as suitable for use in wet areas.)

A. Measure each wall and mark centers

B. Draw lines between centers of opposite walls

C. Check wall cuts using sheets of tiles or by measuring

D. Adjust starting lines to permit wall cuts of more than one-half tile

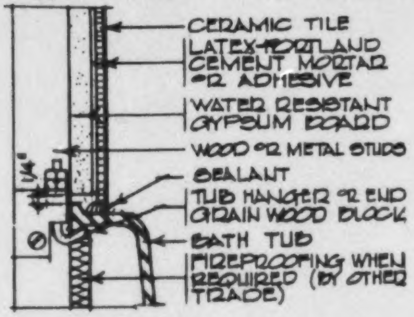
WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #7 — INSTALL A TUB SURROUND

I. Details and guidelines from TCA *Handbook* (Figure 25)

FIGURE 25

Gypsum Board **B413-82**


CERAMIC TILE
LATEX-PORTLAND CEMENT MORTAR OR ADHESIVE
WATER RESISTANT GYPSUM BOARD
WOOD OR METAL STUDS
SEALANT
TUB HANGER OR END GRAIN WOOD BLOCK
BATH TUB
FIREPROOFING WHEN REQUIRED (BY OTHER TRADE)

Recommended Uses:
- in tub enclosures and tub-showers over water-resistant gypsum backing board on wood or metal studs.

Requirements:
- to be used in conjunction with Methods W223, W242 or W243.
- water resistant gypsum backing board single layer thickness shall be minimum 1/2" thick over studs spaced at maximum 16" o.c.
- water resistant gypsum backing board shall be applied horizontally with the factory paperbound edge spaced a minimum of 1/4" above the lip of the tub.

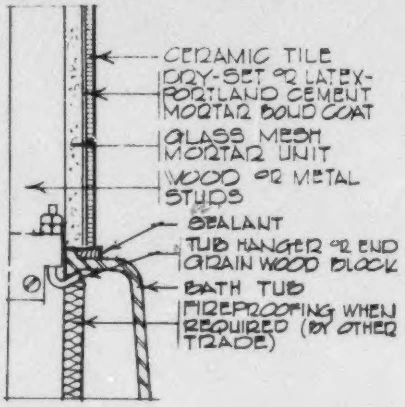
Materials:
- see Methods W223 or W242.

Preparation by Other Trades:
- bathtub installed level and supported with metal hangers or on end grain wood blocks.
- fireproofing behind tub when required.
- all openings cut in backing board for plumbing and all cut joints between adjoining pieces shall be sealed with adhesive or other materials recommended by manufacturer of backing board.
- all gypsum backing board joints shall be treated with tape and joint compound bedding coat only (no finish coat).

Preparation by Tile Trade:
- seal surface of taped joints in water resistant gypsum backing board installations to prevent water damage.
- prime surface before applying adhesive when recommended by adhesive manufacturer.
- allow minimum of 24 hrs. after tile is set for solvent evaporation before grouting.

Installation Specifications:
- organic adhesive — Methods W223 or W242.
- latex-p.c. mortar — Method W243.

Glass Mesh Mortar Unit


CERAMIC TILE
DRY-SET OR LATEX-PORTLAND CEMENT MORTAR BOND COAT
GLASS MESH MORTAR UNIT
WOOD OR METAL STUDS
SEALANT
TUB HANGER OR END GRAIN WOOD BLOCK
BATH TUB
FIREPROOFING WHEN REQUIRED (BY OTHER TRADE)

Recommended Uses:
- in wet areas.
- over dry, well braced wood studs or furring.
- over well braced metal studs.

Requirements:
- set tile in Dry-Set or latex-portland cement mortar.
- stud spacing not to exceed 16' o.c.
- minimum recommended stud width is 3 1/2".
- metal studs shall be 20 gauge or heavier.

Materials:
- 7/16" glass mesh mortar units.
- 2" glass fiber mesh tape.
- Dry-Set mortar — conform with ANSI A118.1.
- latex-portland cement mortar — conform with ANSI A118.4.
- expansion joints (see Page 28).
- grout — specify type (see Pages 7 & 10).

Preparation by Tile Trade:
- all horizontal and vertical joints and corners shall have a 1/8" spacing which must be filled solid with Dry-Set or latex p.c. mortar.
- 2" glass fiber mesh tape shall be embedded in a skim coat of the mortar over the joints and corners.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- refer to ANSI installation specification.

Installation Specifications:
- glass mesh — in accordance with manufacturer's literature.
- tile — ANSI A108.5.

JOB SHEET #7

II. Tools and materials

A. Tools

1. Carbide nippers
2. Margin trowel
3. Notched trowel (proper notched trowel for type of bonding material)
4. Steel measuring tape or wood folding rule
5. Pails
6. Tile cutter
7. Sponges
8. Rubber grouting trowel
9. Hole breaker and/or hole saw
10. Rub brick (stone)
11. Joint striking tool
12. Levels
13. Gauging trowel
14. Electric drill and bit (¼")
15. Beating block
16. Rubber mallet or hammer
17. Nippers
18. Pencil
19. Carbide-tipped chisel

B. Materials

1. Tile
2. Trim

JOB SHEET #7

3. Mortar or adhesive

   (NOTE: Over water-resistant gypsum board use organic adhesive or latex-portland cement mortar. Over glass mesh mortar units use dry-set mortar or latex-portland cement mortar.)

4. Dry-set grout
5. Liquid latex additive
6. Source of clean, potable water
7. Elastomeric sealant
8. Required accessories and fixtures
9. Tub protective material
10. Silicone rubber grout
11. Fixture adhesive if specified by fixture manufacturer
12. Masking tape

III. Procedure to prepare wall for installation over water-resistant gypsum board

   A. Inspect gypsum board

      1. Check to see that wall is clean, dry, and free of oily or waxy films
      2. Check to see that walls are true and level with square corners

         (CAUTION: Wall must be within 1/8" in 8'-0" of the required plane for installations using organic adhesive.)

      3. Check to see that cuts and cut-outs have been caulked and sealed
      4. Check to see that wall studs do not exceed 16" o.c.
      5. Check that gypsum board is installed horizontally with paper edge down and that 1/4" gap has been left between gypsum board edge and tub or shower receptor
      6. Check to see that gypsum board joints are sealed with tape and joint compound with no finish coat

JOB SHEET #7

7. Check to see that joint compound has not been applied over nailheads in area to be tiled

   (CAUTION: Do not proceed with installation if wall surfaces do not meet these conditions. Contact owner or contractor.)

B. Wipe down gypsum board to remove dust

C. Seal plumbing openings and joints between gypsum board and tub with elastomeric sealant

D. Lay out installation

E. Prime surface prior to installation if required by adhesive manufacturer

IV. Procedure to prepare wall for installation over glass mesh mortar units

A. Install glass mesh mortar units

   (NOTE: See Job Sheet #1.)

B. Seal plumbing openings and joints between tub and glass mesh mortar units with dry-set mortar or latex-portland cement mortar

   (CAUTION: Fill joints solid. Check to see that mortar contacts glass mesh mortar units and tub all the way around the perimeter of the installation and fills plumbing openings completely solid with mortar leaving no voids.)

C. Lay out installation

V. Procedure for installation

A. Mix mortar if required

   (CAUTION: Do not mix any mortar unless the proper notched trowel is available. Refer to ANSI specifications and TCA guidelines.)

   1. Follow manufacturer's instructions carefully
   2. Mix mortar thoroughly using water or required additive
   3. Let stand for approximately fifteen minutes
   4. Remix

   (CAUTION: Do not add any additional liquid or powder.)

JOB SHEET #7

B. Check open time for mortar or adhesive

(CAUTION: Temperature and humidity govern open time. Bond coat must be wet to touch at time of installation.)

C. Apply bond coat

(NOTE: Begin tub surround installation with back wall. Leave starting lines visible.)

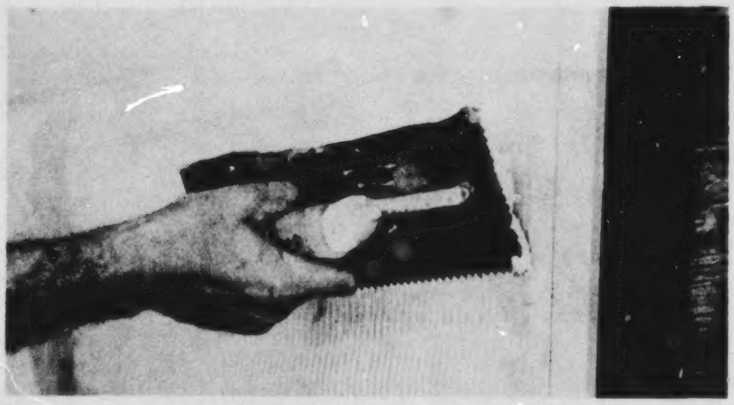
1. Use flat side of trowel to apply skim coat, starting at bottom of backerboard and working upward

   (NOTE: Cover enough area for about two rows of tile.)

2. Apply additional adhesive or mortar with proper notched trowel and comb (Figure 26)

   (CAUTION: Cover surface uniformly without bare spots.)

FIGURE 26



D. Install tiles beginning at starting line with first row next to tub rim

(CAUTION: Leave 1/16" gap between tile and tub rim to receive sealant.)

(NOTE: Cut edges should be smoothed with rub brick and placed toward end walls.)

JOB SHEET #7

E. Press and twist tiles into place; beat with beating block to ensure proper bond

(CAUTION: Average contact between tile back and bond coat must be as close to 100 percent coverage as possible. Mortar bed thickness for dry-set or latex portland cement mortar should be $^{3}/_{32}$" to $^{1}/_{8}$" after beat-in.)

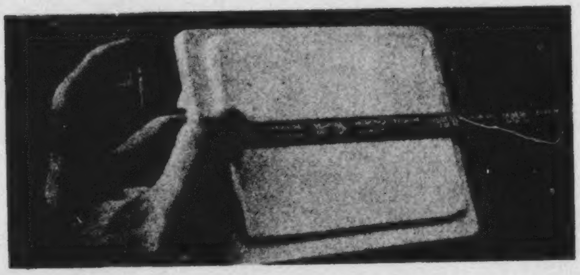
F. Clean tiles with damp sponge or nylon scouring pads to remove excess bonding material as you install tiles

G. Continue back wall installation

1. Remove filmed over bond coat and replace with fresh
2. Use margin trowel or spacers to maintain joints
3. Use accessories to check required cuts; remove tiles, cut, and replace as required (Figure 27)

   (NOTE: Place cut edges toward fixture. Allow approximately $^{1}/_{8}$" joint for leveling fixture.)

FIGURE 27



4. Clean excess mortar or adhesive from tile joints when wall is finished

H. Repeat procedure for other walls

(NOTE: Layout should start with full tile against back wall.)

1. Cut holes in tile for water pipes and controls

   (CAUTION: Cut holes to provide close fit. Do not split tile to fit around pipes and controls.)

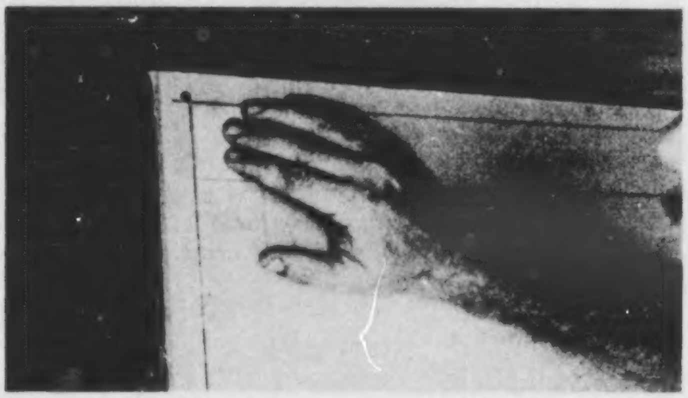
2. Remove, cut, and replace tiles to allow room for accessories as required

JOB SHEET #7

I. Install trim

1. Press and twist down angles firmly into place (Figure 28)

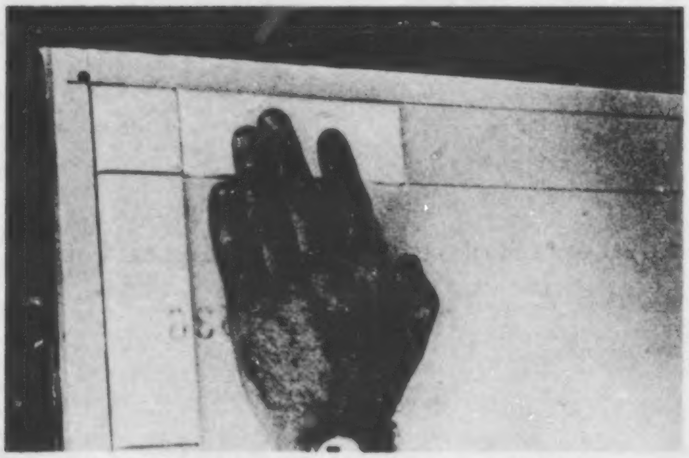
FIGURE 28



2. Butter the backs of surface cap; press and twist into place, starting at angle and installing toward floor and then toward back wall (Figure 29)

   (NOTE: Surface caps and angles may not have lugs for grout joints. Use spacers to match trim grout joint widths to those on field tile.)

FIGURE 29



JOB SHEET #7

3. Use rub brick to smooth cuts as required
4. Use nippers to cope surface cap to fit in corners
5. Beat into place with beating block and a hammer

J. Thoroughly clean all tile surfaces with sponge dipped in clean water and wrung damp

K. Clean tools and work area; remove waste

L. Allow to cure before grouting

(NOTE: Organic adhesive must cure for at least 24 hours to allow solvent to evaporate. Dry-set and latex-portland cement mortars require at least 48 hours to firmly set.)

M. Grout tub surround

N. Install fixtures

O. Clean tools and area; remove waste

P. Allow to cure at least seventy-two hours before use

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

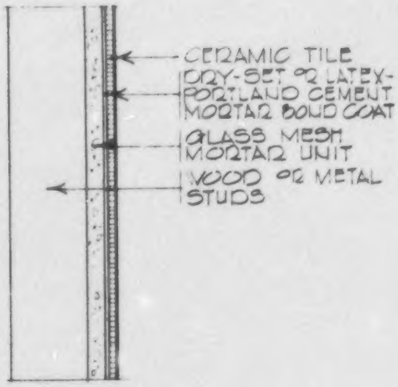
JOB SHEET #8 — INSTALL TILE IN SHOWER STALL

I. Details and guidelines from TCA *Handbook* (Figures 30 and 31)

FIGURE 30

WALLS, INTERIOR
Wood or Metal Studs
Glass Mesh Mortar Unit

**Dry-Set Mortar or Latex
Portland Cement Mortar** **W244-82**



Recommended Uses:
- in wet areas.
- over dry, well braced wood studs or furring.
- over well braced metal studs.

Requirements:
- set tile in Dry-Set or latex-portland cement mortar.
- stud spacing not to exceed 16" o.c.
- minimum recommended stud width is 3 1/2".
- metal studs shall be 20 gauge or heavier.

Materials:
- 7/16" glass mesh mortar units.
- 2" glass fiber mesh tape.
- Dry-Set mortar — conform with ANSI A118.1.
- latex-portland cement mortar — conform with ANSI A118.4.
- expansion joints (see Page 28).
- grout — specify type (see Pages 7 & 10).

Preparation by Tile Trade:
- all horizontal and vertical joints and corners shall have a 1/8" spacing which must be filled solid with Dry-Set or latex p.c. mortar.
- 2" glass fiber mesh tape shall be embedded in a skim coat of the mortar over the joints and corners.

Expansion Joint (architect must specify expansion joints and show location and details on drawings):
- refer to ANSI installation specification.

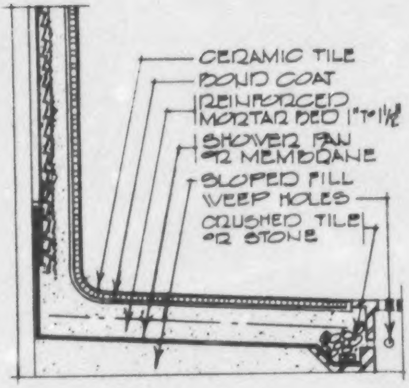
Installation Specifications:
- glass mesh — in accordance with manufacturer's literature.
- tile — ANSI A108.5.

JOB SHEET #8

FIGURE 31

SHOWER RECEPTOR

Cement Mortar **B414-82**


CERAMIC TILE
BOND COAT
REINFORCED MORTAR BED 1" TO 1 1/2
SHOWER PAN OR MEMBRANE
SLOPED FILL
WEEP HOLES
CRUSHED TILE OR STONE

Recommended Uses:
- over wood or concrete subfloors.

Requirements:
- slope required in pan or membrane 1/4" per ft. to weep holes in drain.
- membrane or pan to turn up wall at least 3" above shower curb.

Materials:
- portland cement — ASTM C-150 Type 1.
- sand — ASTM C-144.
- mortar — 1 part portland cement, 4 parts damp sand by volume. (Use an admixture to make mortar bed water resistant.)
- reinforcing — 2" × 2" 16/16 gauge wire mesh or equivalent.
- grout — specify type (see Pages 7 & 10).

Preparations by Other Trades:
- shower floor membrane as required by local Administrative Authority.
- form slope for membrane with cement mortar or preformed liners.

Preparation by Tile Trade:
- surround drain with broken pieces of tile or crushed stone to prevent mortar from blocking weep holes.

Installation Specifications:
- ANSI A108.1.

II. Tools and materials

A. Tools

1. Wood chisel (1 1/2")
2. Cement chisel (1/2")
3. Carbide nippers
4. Rub brick (stone)
5. Rubber grouting trowel

JOB SHEET #8

6. Beating block
7. Notched trowel (proper notched trowel for type of bonding material)
8. Pails
9. Rubber hammer
10. Rubber mallet
11. Sponges
12. Wood folding rule or steel measuring tape
13. Tile cutter
14. Tile saw
15. Margin trowel
16. Water brush
17. Straightedges

    (NOTE: Notch one end of straightedge the thickness of the floor tile.)
18. Gauging trowel
19. Levels (24" and 48")
20. Claw hammer
21. Mortar box
22. Mortar hoe
23. Square-edged shovel
24. Carbide-tipped scoring tool
25. Cement trowel
26. Tin snips
27. Carbide-tipped chisel (1/4")
28. Razorblade knife
29. Clean terry cloths

JOB SHEET #8

30. Framing square
31. Test plug for shower drain
32. Nylon scouring pads

B. Materials

1. Mortar
2. Grout
3. Latex additive if desired
4. Wall and ceiling tile
5. Floor tile (mounted mosiac)
6. Trim
7. Type I portland cement (2 sacks)
8. Fine masonry sand (approx. 20 gal)
9. Elastomeric sealant
10. Materials for barricade
11. Bricks
12. Waterproof membrane
13. Hydrated lime

III. Procedure for preparing shower for tile installation

A. Install waterproof membrane, if not previously installed

1. Check to make sure that studs have been notched 1/4" deep up to height of membrane, leaving room for membrane behind backing board

   (NOTE: It may not be necessary to notch studs for certain types and thicknesses of membranes.)

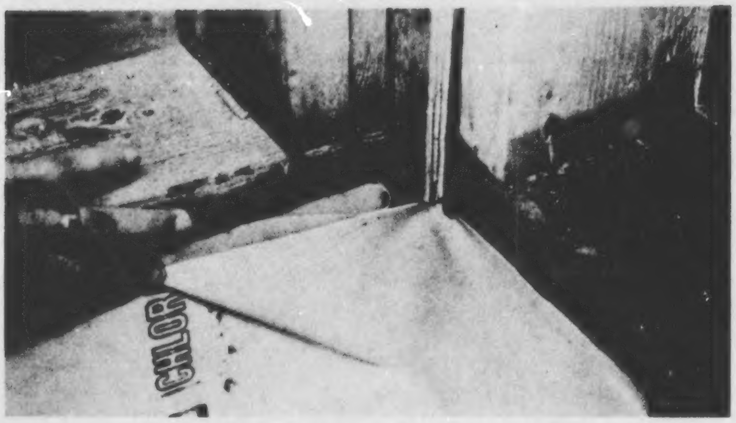
2. Cut membrane large enough to cover floor and lap wall at least three inches above top of curb

JOB SHEET #8

3. Fold corners well into the bottom and up wall (Figure 32)

   (CAUTION: Fold corners only; do not cut. Local codes may require protection against water penetration at junction of shower opening and curb.)

FIGURE 32



4. Nail membrane at top edge only at each stud

5. Cut hole for drain with a razorblade knife

   (NOTE: Make hole just large enough to fit the pipe.)

6. Seal bottom and top of membrane around drain

7. Screw the large clamping ring down tight over membrane

B. Test membrane for leakage if not previously tested

1. Install drain plug

   (NOTE: Be sure that drain plug does not leak.)

2. Fill membrane with water as high as possible, at least four inches

   (NOTE: It may be necessary to hold membrane in place across door opening.)

3. Allow water to stand twenty-four hours

JOB SHEET #8

4. Check for leaks after twenty-four hours

   (NOTE: If membrane leaks, repair or replace as necessary and retest.)

C. Drain water if required and protect membrane with layer of sand or scrap cardboard

D. Reinstall drain

E. Plug drain with rag to prevent entry of foreign matter

F. Install glass mesh mortar unit on ceiling and walls, if required

G. Apply primer if required by organic adhesive manufacturer

H. Build shower curb

IV. Procedure for installing ceiling tile

A. Spread bond coat

B. Apply additional adhesive or mortar and comb

   (CAUTION: Completely fill gaps between glass mesh mortar units when bond coat is applied.)

C. Install tiles beginning at intersection of the starting lines, cutting tiles as required

D. Press and twist tile into place; beat tiles with beating block

V. Procedure for installing tile on walls

A. Install mortar screed

B. Mix mortar if required

   (CAUTION: Do not mix any mortar unless the proper notched trowel is available. Refer to ANSI specifications and TCA guidelines.)

   1. Follow manufacturer's instructions carefully

   2. Mix mortar thoroughly using water or required additive

   3. Let stand for approximately fifteen minutes

   4. Remix

      (CAUTION: Do not add any additional liquid or powder.)

JOB SHEET #8

B. Check open time for mortar or adhesive

(CAUTION: Temperature and humidity govern open time. Bond coat must be wet to touch at time of installation.)

C. Apply bond coat

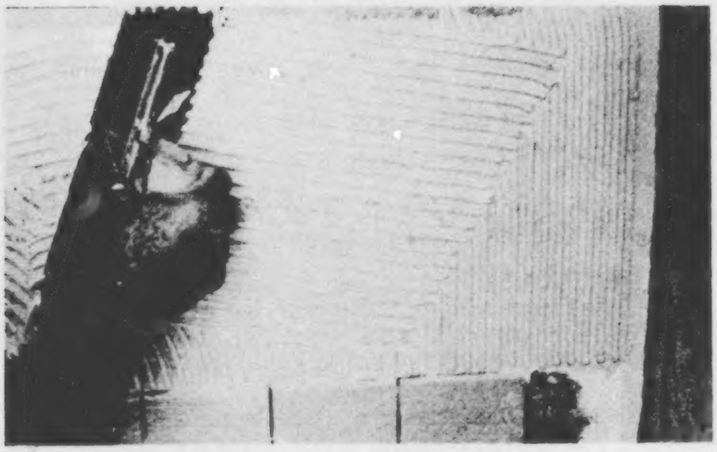
(NOTE: Begin shower stall installation with base trim. Leave starting lines visible.)

1. Use flat side of trowel to apply skim coat, starting at screed and working upward

2. Apply additional adhesive or mortar with notched trowel and comb (Figure 33)

   (CAUTION: Cover surface uniformly without bare spots.)

FIGURE 33



3. Set base tile on screed from starting point pressing firmly into setting material with proper joint widths

   (NOTE: Use margin trowel to maintain joint spacing. Use string, pegs, or wood or plastic spacers if tile has no spacers.)

4. Make base cuts at corners if required

5. Use nippers to cut cove at forty-five degree angle to fit corner; rub smooth

JOB SHEET #8

D. Trim shower door jamb sides if required

(NOTE: Trim must be installed first on the jamb sides or on outside corners that are trimmed. Many showers are built without door jamb sides and do not require trimming.)

1. Spread bond coat
2. Apply additional adhesive or mortar and comb
3. Press surface angles into place at top and bottom of jamb sides as required
4. Install remaining trim on jamb sides
5. Beat into place with beating block

E. Install field tile

1. Spread bond coat
2. Apply additional adhesive or mortar and comb
3. Set about two rows at a time beginning at the starting line

   (NOTE: Cut edges should be smoothed with rub brick and placed toward walls.)

3. Press and twist tiles into place; beat with beating block to ensure proper bond

   (CAUTION: Average contact between tile back and bond coat must be as close to 100 percent coverage as possible. Mortar bed thickness for dry-set or latex portland cement mortar should be $^{3}/_{32}$" to $^{1}/_{8}$" after beat-in.)

   (NOTE: Include base trim in beat-in procedure.)

F. Clean tiles with damp sponge or nylon scouring pads to remove excess bonding material as you install tiles

G. Remove any filmed over bond coat and replace with fresh material

H. Use margin trowel or spacers to maintain joints

I. Use accessories to check required cuts; remove tiles, cut, and replace as required

(NOTE: Place cut edges toward fixture. Allow approximately $^{1}/_{8}$" joint for leveling fixture.)

JOB SHEET #8

J. Cut holes in tile for water pipes and water control valves

(CAUTION: Cut holes to provide close fit. Do not split tile to fit around pipes and controls.)

K. Clean excess mortar or adhesive from joints when wall is finished

L. Repeat procedure for other walls

M. Clean tools and work area; remove waste

N. Allow to cure before grouting

(NOTE: Organic adhesive must air for at least 24 hours to allow solvent to evaporate. Dry-set and latex-portland cement mortars require at least 48 hours to firmly set.)

O. Grout ceiling and walls

P. Install fixtures as required

VI. Procedure for installing floor tile

A. Remove sand or cardboard covering from membrane

B. Prepare floor for tile installation

(NOTE: See Job Sheet #3.)

C. Allow floor to harden if using dry-set mortar

D. Spread dry-set mortar if required

E. Install sheets of ceramic mosaic floor tile, making cuts as required

(CAUTION: Make sure that tile sheets are suitable for wet area installations.)

F. Remove tiles for drain as necessary

G. Beat tiles well into mortar with beating block, making sure tile is flush with drain and base trim

(NOTE: Avoid putting weight on floor.)

H. Use damp sponge or nylon scouring pad to clean surface of tiles

I. Clean tools and work area; remove all waste if cure is required

J. Grout floor

K. Clean tools and work area; remove all waste

L. Barricade shower for at least 72 hours

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #9 — GROUT WET AREA INSTALLATION

I. Tools and materials

   A. Pails

   B. Commercial portland cement grout

   C. Latex additive

   D. Source of clean, potable water

   E. Margin trowel

   F. Gauging trowel

   G. Sponges (good assortment)

   H. Joint striking tool

   I. Clean terry cloth towels

   J. Rubber grouting trowels (wall- and floor-type)

   K. Elastomeric sealant

II. Procedure

   A. Mix grout

      1. Follow manufacturer's instructions carefully

      2. Mix latex additive

      3. Stirring vigorously with margin trowel, add small amounts of commercial portland cement grout powder

      4. Mix well with margin trowel until mixture reaches smooth, no-slump consistency

      5. Let stand for fifteen minutes

      6. Remix

      (CAUTION: Do not add additional powder or liquid.)

JOB SHEET #9

B. Grout tile

(CAUTION: Remove spacers if used before grouting.)

(NOTE: In showers, begin with ceiling.)

1. Dampen tiles with sponge, if necessary

2. Force grout well into joints, using pressure on grouting trowel

   (CAUTION: Fill all gaps and skips. Do not permit mortar to show through grouted joints.)

3. Move grouting trowel diagonally across joints, transferring grout to ungrouted areas and removing excess grout with float

4. Use striking tool to strike narrow joints; use damp sponge to smooth wide joints

   (CAUTION: Finish joints of cushion edge tile smoothly to depth of cushion. Joints for square edge tiles should be flush with surface.)

   (NOTE: Change water frequently to keep it clean.)

5. As haze appears, polish tiles with clean terry cloths

   (NOTE: Finished grout should be uniform in color, smooth, and without voids, pin holes, or low spots. All tiled surfaces must be clean.)

C. Repeat procedure for remaining walls

D. Install fixtures

E. Seal joint between tile and tub rim for tub surround installations with elastomeric sealant

(CAUTION: Fill joint completely without voids. Check to make sure that sealant contacts tub and tile.)

F. Repeat grouting procedure for shower floor, if required, when tile has properly set

G. Clean tools and work area; remove waste

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #10 — INSTALL FIXTURES

I. Tools and materials

   A. Required fixtures

   B. Razor blade knife

   C. Electric drill and carbide bit

   D. Margin trowel

   E. Pails

   F. Screwdrivers

   G. Mortar

   H. Grout

   I. Silicone rubber grout

   J. Carbide-tipped chisel

   K. Masking tape

   L. Source of clean, potable water

   M. Hacksaw

   N. Clean terry cloth towels

   O. Sponges (good assortment)

   P. Wire mesh or screen for recessed fixtures

II. Procedure

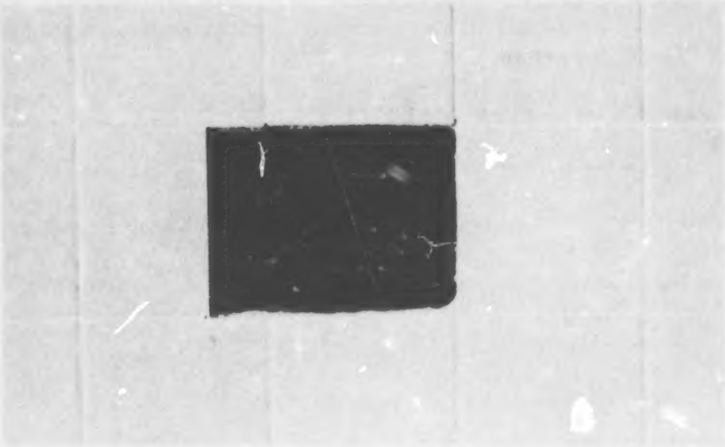
   A. Clean installation material from fixture area

JOB SHEET #10

B. Install recessed or semirecessed fixtures

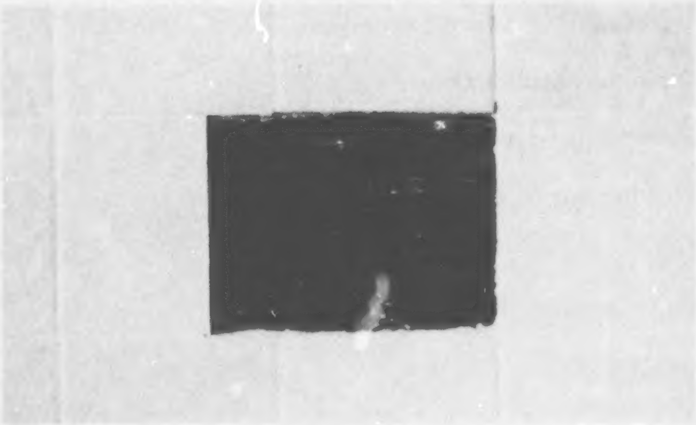
1. Cut out installation area with razorblade knife if gypsum board or carbide-tipped chisel if glass mortar units (Figure 34)

FIGURE 34



2. Seal edges of gypsum board cut out with sealant
3. Shape wire mesh or screen into a basket and insert in hole (Figure 35)

FIGURE 35



JOB SHEET #10

4. Mix dry-set mortar
    a. Follow manufacturer's instructions carefully
    b. Add dry-set mortar to water and mix thoroughly until you reach a smooth, no-slump consistency

        (NOTE: Mortar mixed to install recessed fixtures must be of a very thick consistency.)
    c. Let mixture stand for approximately fifteen minutes
    d. Remix

        (CAUTION: Do not add additional liquid or powder.)
5. Fill wire basket with mortar to allow 100 percent coverage of the back of the fixture (Figure 36)

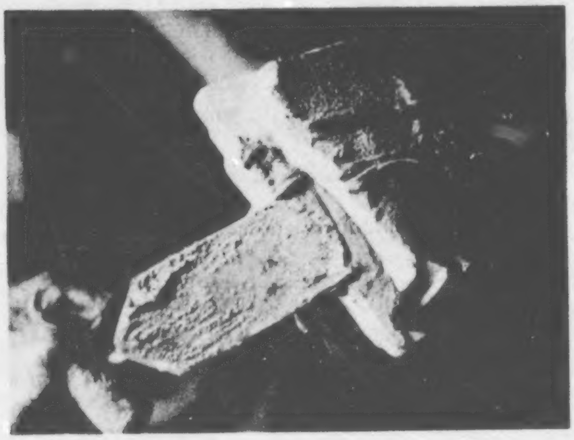
FIGURE 36

JOB SHEET #10

6. Butter back and recessed sides of fixture; butter edges of opening (Figure 37)

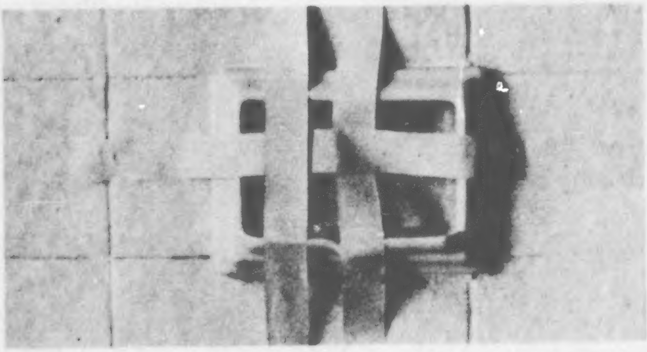
   (NOTE: Also butter flange if so equipped.)

FIGURE 37



7. Press fixture into mortar, applying pressure evenly
8. Clean excess mortar from fixture and surrounding tile
9. Adjust fixture square and level
10. Support fixture with masking tape or other means until mortar cures (Figure 38)

FIGURE 38

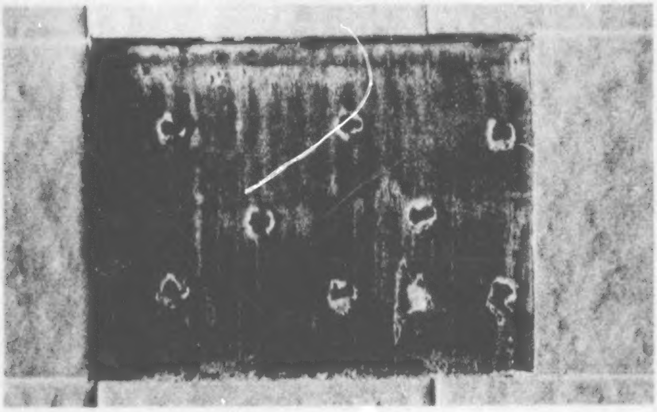


JOB SHEET #10

D. Install surface-mounted fixtures

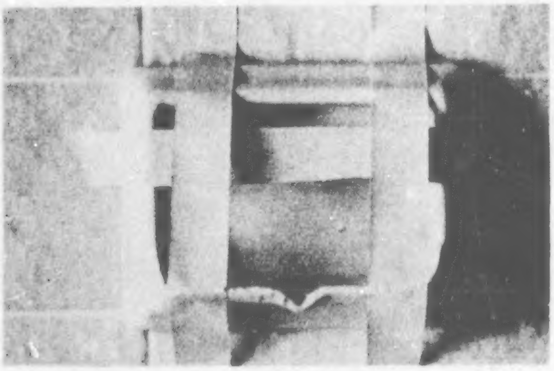
1. Drill holes through gypsum board or cut holes in glass mesh mortar units with carbide-tipped chisel where fixture is to be mounted (Figure 39)

FIGURE 39



2. Clean mounting surface
3. Butter fixture with mortar or adhesive recommended by manufacturer for type of backer board
4. Fill surface holes with mortar or adhesive
5. Press and twist fixture firmly into place; hold in place under pressure for five to ten seconds (Figure 40)

FIGURE 40



JOB SHEET #10

6. Clean excess mortar from fixture and surrounding tile with damp sponge
7. Adjust fixture square and level
8. Support fixture with masking tape or other means until bond coat cures

E. Install grab bar

(NOTE: Grab bars are normally installed over the finished tile.)

1. Locate ends of grab bar centered at studs
2. Drill holes at required locations to mount one end of grab bar; drill through tile and backing board into stud
3. Fill holes with elastomeric sealant
4. Mount one end of grab bar (Figure 41)

FIGURE 41

JOB SHEET #10

5. Position other end of grab bar until it matches center of another stud (Figure 42)

   (NOTE: It may be necessary to set the grab bar at a slight angle.)

FIGURE 42

6. Drill required holes and fill with sealant

7. Secure with screws

F. Remove masking tape or other devices when completely set

G. Grout around fixtures as required

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #11 — INSTALL A SHOWER DOOR

I. Tools and materials

A. Shower door

B. Accessories for shower door

C. Level

D. Sharp steel punch

E. Electric drill

F. Carbide bit

G. Wood bits

H. Screwdriver

I. Elastomeric sealant

J. Clean cloths

II. Procedure

A. Check to determine which way door is to swing

(NOTE: Doors are available with either right- or left-hand hinges. The contractor determines direction of door swing; if for any reason you doubt the swing of the door, consult the contractor.)

B. Hold door in center of curb against door facing

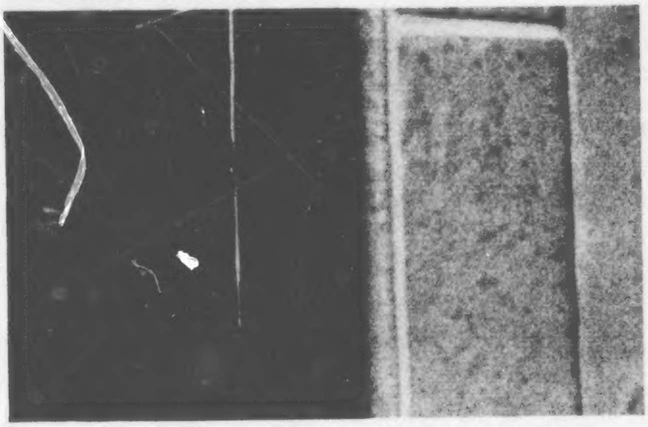
C. Using the level, plumb with wall

JOB SHEET #11

D. Mark screw holes with a sharp punch, tapping lightly to prevent breakage (Figure 43)

(CAUTION: Make sure the hinged jamb rests on the top of the curb. The door should swing out and clear of any object. Be sure the correct side of the door swings out.)

FIGURE 43



E. Select carbide bit to fit screws

F. Drill through tile *only*, using electric drill

G. Select a smaller wood bit to drill holes smaller and shorter than wood screws that came with door

(NOTE: The wood screws should be about three inches long.)

H. Mount hinged side jamb piece into wall making sure that it is plumb

I. Hold other side jamb piece against door

J. Close door against this loose jamb; fit the jamb snugly against the door and mark holes with metal punch

(NOTE: The door should be in same place as the hinged jamb.)

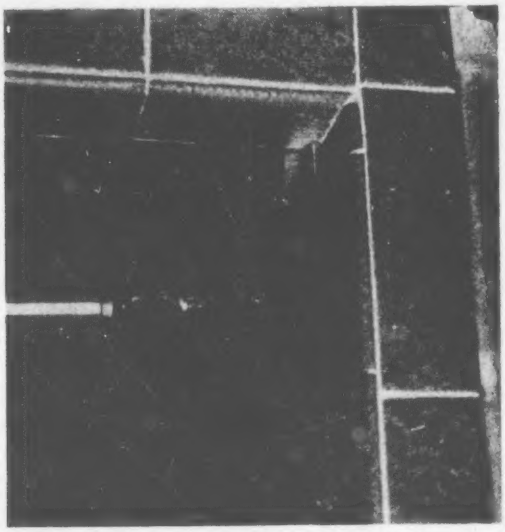
JOB SHEET #11

K. Drill through tile with carbide bit

L. Drill into wood with smaller wood bit

M. Mount frame with top screw (Figure 44)

FIGURE 44



N. Close door to line up jamb perfectly the length of door

O. Mark holes and push jamb to one side to drill

P. Insert and tighten all three screws

Q. Attach rubber strip at bottom of door if it has not been preinstalled

R. Install door hardware

EXAMPLES: Towel bar that also serves as an outside handle, smaller bar inside door to use as a handle

S. Seal jamb sides with elastomeric sealant

T. Smooth sealant with a damp cloth

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

JOB SHEET #12 — INSTALL TUB ENCLOSURE DOORS

I. Tools and materials

- A. Sliding (bypass) doors, usually 60"

  (NOTE: Some doors are larger for openings other than into tubs, but all sliding doors are installed using the same basic procedures.)

- B. Assessories for sliding doors
- C. Hacksaw
- D. Miter box
- E. Elastomeric sealant
- F. Level (4')
- G. Claw hammer
- H. Carbide bits
- I. Electric drill
- J. Margin trowel
- K. Screwdriver
- L. Pail
- M. Clean cloths
- N. Sharp metal punch

II. Procedure

- A. Measure distance of opening after tile is installed
- B. Use a hacksaw and miter box to cut the tub track and header track pieces to the same length as opening
- C. Insert vinyl strips on both sides of vertical frame pieces
- D. Lay a bead of elastomeric sealant on top front rim of tub where tub track will be placed

JOB SHEET #12

E. Lay tub track in place

F. Clean excess sealant from tub rim with clean cloth wrung out damp

G. Hold one wall jamb piece in place against wall

(NOTE: End pieces will straddle the bottom part of the frame.)

H. Plumb the jamb with a level

I. Mark the three holes with a sharp punch, tapping tile lightly to prevent breakage

(NOTE: This mark will serve as a guide for drilling. It may be easier to mark holes with pencil and then tap.)

J. Select a carbide bit to fit the plastic anchors

K. Drill through tile and backing with electric drill

(NOTE: Holes must be deep enough to accomodate full length of screws.)

L. Insert anchors flush with tile and tap with the handle of margin trowel

M. Insert screws and mount jamb piece on wall

N. Install other jamb piece on opposite wall

O. Lay header track on two end pieces and insert one door into it

P. Slide door to wall to see how it lines up with jamb

(NOTE: The door should fit squarely against inside of frame. If the door is not square, remove door, and adjust rollers that support it.)

Q. Adjust door to fit snugly against jamb

(NOTE: The inside door should be at the end of the tub containing the shower head. It should overlap the outside door. This prevents water from getting through the crack between the doors.)

R. Seal the jamb pieces and tub track inside and out with elastomeric sealant, taking care to make the surface smooth; use a damp cloth

(NOTE: Install the towel bar on the outside door. Install the handles on the inside door.)

S. Install rubber bumpers on middle screw of end bars to prevent doors from bumping against metal frame

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

TEST

NAME ________________________________ SCORE ______________

1. Match to their correct definitions terms associated with wet area installations. Definitions continue on next page.

_____a. Laying of tile half off center

_____b. Laying tile at a forty-five degree angle

_____c. Anything not reusable left over from tile installation

_____d. Thin coat of setting material applied with flat side of trowel using pressure to get a good mechanical bond

_____e. Material used to adhere the back of a ceramic tile to a prepared surface

_____f. Squared line where tile is to start

_____g. Tile units of various shapes and sizes used to complete an installation of desired sanitary or architectural design

_____h. Surface to receive ceramic tile

_____i. Two end walls and back wall surrounding tub; usually sixty inches high or covers area just above shower head

_____j. Elastomeric material used to fill and seal joints; prevents passage of moisture and allows horizontal and lateral movement at joint

_____k. To spread a bond coat on back of a ceramic tile just before tile is placed

_____l. Material used to provide a positive waterproof floor over substrate which is to receive a tile installation using a wire-reinforced mortar bed

1. Backing board
2. Bond coat
3. Broken joint
4. Butter
5. Diagonal joint
6. Metal lath
7. Screed
8. Sealant
9. Skim coat
10. Starting line
11. Trim
12. Tub surround
13. Waste
14. Waterproof membrane

TEST

_____m. Strip of wood, metal, mortar, or other material applied to a surface; used as guide on which a straight edge is worked to obtain a true mortar surface

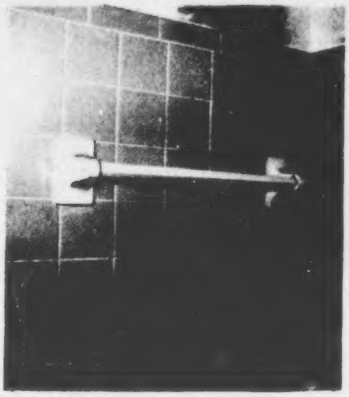
_____n. Mesh which acts as a background and reinforcing agent for the scratch or mortar coat

2. Name two examples of normal residential wet area installations.

a. ______________________________

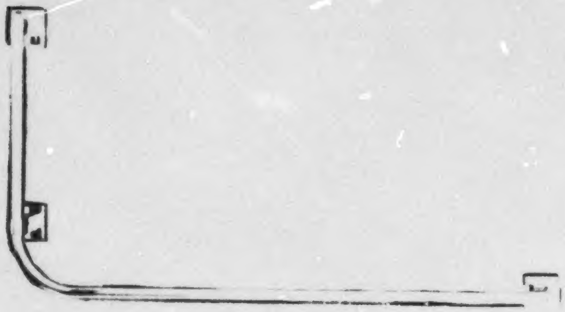
b. ______________________________

3. Name types of ceramic bathroom accessories.

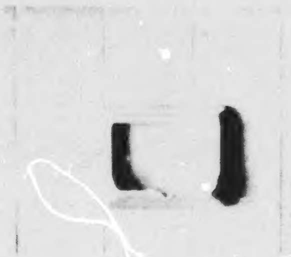


a. ____________________ b. ____________________

TEST



c. ______________________________



d. ______________________________

e. ______________________________

(NOTE: Test questions 4-6 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

4. Interpret ANSI specifications and TCA guidelines for wet area wall, floor, and ceiling tile installations.

5. Interpret labels from products used in wet area wall, floor, and ceiling tile installations.

6. Demonstrate the ability to

   a. Install glass mesh mortar units in a tub surround.

   b. Install glass mesh mortar units in a shower.

TEST

c. Prepare shower floor for tile installation.

d. Build a shower curb.

e. Lay out a tub surround.

f. Lay out a shower.

g. Install a tub surround.

h. Install tile in shower stall.

i. Grout wet area installation.

j. Install fixtures.

k. Install shower door.

l. Install tub enclosure.

WET AREA WALLS, FLOORS, AND CEILINGS
UNIT IV

ANSWERS TO TEST

1.

a.	3	e.	2	i.	12	m.	7
b.	5	f.	10	j.	8	n.	6
c.	14	g.	11	k.	4		
d.	9	h.	1	l.	14		

2. (In either order)
   a. Shower
   b. Tub surround
3. a. Towel bar
   b. Shower door
   c. Grab bar
   d. Soap dish
   e. Sliding doors on tub
4. Evaluated to the satisfaction of the instructor
5. Evaluated to the satisfaction of the instructor
6. Performance skills evaluated to the satisfaction of the instructor

RENOVATION AND REPAIR
UNIT V

UNIT OBJECTIVE

After completing this unit, the student should be able to complete common renovations and repairs involving ceramic tile. This knowledge will be shown by completing job sheets, assignment sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Define terms associated with completing ceramic tile renovations or repairs.
2. State questions that must be considered before renovating or repairing ceramic tile.
3. Name types of repair jobs performed by tile setter.
4. State guidelines for performing repairs.
5. Select from a list reasons for replacing grout.
6. Select from a list guidelines for installing tile over existing floor.
7. Select from a list guidelines for installing ceramic tile over ceramic tile on walls or floor.
8. Interpret ANSI specifications and TCA guidelines used in renovating and repairing tile installations.
9. Interpret labels of products used in renovating and repairing tile installations.
10. Demonstrate the ability to
    a. Replace loose or damaged tile.
    b. Replace damaged bathroom accessories.
    c. Replace grout.
    d. Clean aged tile.
    e. Remove and replace shower floor and base.
    f. Remove and replace existing backing materials in wet area.

OBJECTIVE SHEET

g. Remove and replace backing materials in a dry area.

h. Install ceramic tile over laminated counter top and backsplash.

i. Install ceramic tile over ceramic tile on tub surround.

j. Install ceramic tile over existing floor covering.

RENOVATION AND REPAIR
UNIT V

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order materials planned to supplement unit.

1. *Handbook for Ceramic Tile Installation.* Current edition available from Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

2. "How to Maintain the Beauty of American Olean Ceramic Tile," Folder 364. Available from American Olean Tile Company, 1000 Cannon Avenue, Lansdale, Pennsylvania 19446.

3. *Maintenance Guide CFG for Ceramic Mosaic Floors in General Purpose Areas.* Revised edition available from American Olean Tile Company, 1000 Cannon Avenue, Lansdale, Pennsylvania 19446.

4. *Maintenance Guide GWG for Glazed Tile Walls in General Purpose Areas.* Revised edition available from American Olean Tile Company, 1000 Cannon Avenue, Lansdale, Pennsylvania 19446.

5. *Maintenance Guide QFG for Quarry Tile Floors in General Purpose Areas.* Revised edition available from American Olean Tile Company, 1000 Cannon Avenue, Lansdale, Pennsylvania 19446.

6. *Recommended Specifications for the Application and Finishing of Gypsum Board GA-216-82.* Available from Gypsum Association, 1603 Orrington Avenue, Evanston, Illinois 60201.

B. Provide students with objective sheet.

C. Discuss unit and specific objectives.

D. Provide students with information, assignment, and job sheets.

E. Discuss information and assignment sheets.

F. Demonstrate and discuss procedures outlined in job sheets.

G. Stress to students the importance of renovation and repair jobs in the tile industry.

EXAMPLES: 1. It is estimated that by 1990, the American consumption of tile will reach one billion dollars.

2. When building costs are high, coupled with high interest rates, people will repair their present homes rather than build new homes.

SUGGESTED ACTIVITIES

H. Collect before and after pictures of tile jobs involving renovation or repair; include detailed descriptions of work required.

I. Provide labels of products or actual products so that students can complete Assignment Sheet #2.

J. Prepare mock-ups or arrange job sites for job sheets.

K. Give test after students have completed unit and assignments.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Assignment sheets

1. Assignment Sheet #1 — Interpret ANSI Specifications and TCA Guidelines Used in Renovating and Repairing Tile Installations
2. Assignment Sheet #2 — Interpret Labels of Products Used in Renovating and Repairing Tile Installations

E. Answers to assignment sheets

F. Job sheets

1. Job Sheet #1 — Replace Loose or Damaged Tile
2. Job Sheet #2 — Replace Damaged Bathroom Accessories
3. Job Sheet #3 — Replace Grout
4. Job Sheet #4 — Clean Aged Tile
5. Job Sheet #5 — Remove and Replace Shower Floor and Base
6. Job Sheet #6 — Remove and Replace Existing Backing Materials in Wet Area
7. Job Sheet #7 — Remove and Replace Backing Materials in a Dry Area
8. Job Sheet #8 — Install Ceramic Tile over Laminated Counter Top and Backsplash

SUGGESTED ACTIVITIES

9. Job Sheet #9 — Install Ceramic Tile over Ceramic Tile on Tub Surround

10. Job Sheet #10 — Install Ceramic Tile over Existing Floor Covering

G. Test

H. Answers to test

III. Unit references

A. *American National Standard Specifications for Ceramic Tile A-137.1.* New York: ANSI, 1980.

B. *American National Standard Specifications for the Installation of Ceramic Tile A-108.* New York: ANSI, 1976.

C. *1982 Handbook for Ceramic Tile Installation.* Princeton, New Jersey: Tile Council of America, 1981.

D. *Recommended Specifications for the Application and Finishing of Gypsum Board GA-216-82.* Evanston, Illinois: Gypsum Association, 1982.

E. *Tilesetting Workbook.* Sacramento, California: State Department of Education, 1976.

RENOVATION AND REPAIR
UNIT V

INFORMATION SHEET

I. Terms and definitions

A. Escutcheon — Covering around hot and cold water controls and shower pipe

B. Renovate — To clean and replace worn and broken parts in an effort to make fresh or sound again; to make as though new

C. Repair — To put back in good condition after damage and/or decay

D. Scarify — To make a series of small superficial cuts or abrasions in a surface

E. Screed — Strip of wood, metal, mortar, or other material applied to a surface; used as a guide on which a straightedge is worked to obtain a true mortar surface

F. Shoe base — Wood or vinyl floor trim

G. Weep holes — Slots or holes in drain that enable water to pass through; prevent water from pooling or standing under mortar bed

H. A-cap — Trim piece with ¾" radius (see Figures 1 and 2, page 10)

(NOTE: A-cap is designed for use with conventional installation methods. However, it is useful for thin-set methods over existing tile.)

II. Questions that must be considered before renovating or repairing ceramic tile

A. Are the backing materials suitable for a wet or dry area?

B. Is the new tile to be installed in a wet or dry area?

C. What is the existing covering?

D. Must new backing materials be added?

E. Can type and color of existing tile be matched?

F. Must existing coverings be removed? If so, how much?

G. Can ceramic tile be installed over laminated tops?

H. Can ceramic tile be installed over existing floor coverings?

INFORMATION SHEET

I. Will thresholds be needed?

J. Can ceramic tile be installed over existing ceramic tile?

K. What preparation must be made by other trades?

EXAMPLES: Fireproofing behind tub when required, stud spacing, installation of tub

(NOTE: Determine whether tub is free-standing. If tub has not been hung properly, check with contractor.)

L. What caused the need for repair or renovation?

III. Types of repair jobs performed by tile setter

A. Replacing cracked or chipped tile

B. Replacing tile over water-damaged backing

C. Replacing damaged bathroom accessories

D. Cleaning aged tile installations

E. Replacing shower floor and base

F. Replacing grout

IV. Guidelines for performing repairs (Assignment Sheet #1)

A. Inspect job carefully to estimate extent of damage and materials needed

B. Recommend future care procedures to customer when job is complete

EXAMPLES: Recommend tile care products; caution against use of colored cleansing powders that will discolor grout; caution against use of cleaners that contain acid

V. Reasons for replacing grout

(NOTE: There are many complaints associated with grout, especially in the tub surround and shower areas.)

A. Tile was not grouted correctly during original installation

EXAMPLE: Elastomeric sealant was not used in corners and where tile meets tub rim

INFORMATION SHEET

- B. Wall has shifted, causing grout to crack and/or crumble

  EXAMPLE: Floor joists shifted, floor has dropped, or wood floor joists and studs have shrunk

- C. Grout was not cured properly during original installation
- D. Grout was mixed with too much water
- E. Grout has been cleaned with inappropriate cleaners

VI. Guidelines for installing tile over existing floor

- A. Make certain that floor covering is sound and firmly bonded
- B. Use threshold or bullnose to overcome differences in floor levels with adjoining rooms

  (CAUTION: Customer should understand that changes in floor level may require plumbing, heating, or carpentry remodeling.)

- C. Clean floor thoroughly
- D. Use underlayment if necessary
- E. Use epoxy mortar, organic adhesive, or latex-portland cement mortar if tile installation is over plywood or concrete floor in a dry area
- F. Use epoxy mortar or modified epoxy emulsion mortar on tile installations over resilient floor in dry area

VII. Guidelines for installing ceramic tile over ceramic tile on walls or floor

- A. Be sure existing tile is completely free of soap residue, wax, grease, and dirt

  (NOTE: Use a sanding disc on drill to go over the surfaces to remove scum and scarify surface so that the new tiles adhere better. Remember to wear eye protection when using the sanding disc on drill.)

- B. Be sure that all old tiles are secure

  (NOTE: If any loose tiles are present, remove and clean backs; also clean field thoroughly where tiles have been removed. Butter and replace tiles.)

- C. Use organic adhesive, epoxy or dry-set mortar, or latex-portland cement mortar as the bonding material in dry areas; follow manufacturer's directions

INFORMATION SHEET

D. Use Type I organic adhesive, dry-set mortar, or latex-portland cement mortar as bonding material in wet areas; follow manufacturer's directions

E. Use A-cap over existing tile (Figures 1 and 2)

FIGURE 1

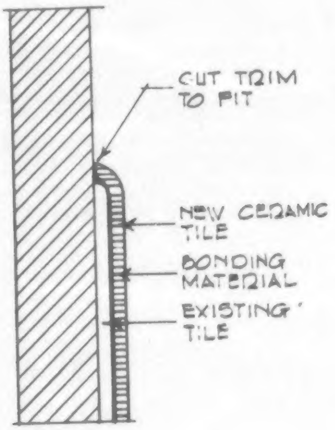
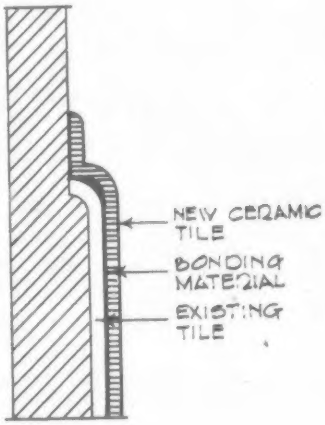

CUT TRIM
TO FIT
NEW CERAMIC
TILE
BONDING
MATERIAL
EXISTING
TILE

FIGURE 2


NEW CERAMIC
TILE
BONDING
MATERIAL
EXISTING
TILE

F. Lay out field as for new tile installation

1. Check doors to see if they must be cut
    a. If doors must be cut, scribe door where it is to be cut off
    b. Remove doors before tiling
2. Make sure there are no small cuts if possible
3. Make sure that field is balanced and opposing cuts are equal

G. When preparing for floor installation, remove shoe base or quarter-round if applicable

H. Complete job as if for new tile installation

RENOVATION AND REPAIR
UNIT V

ASSIGNMENT SHEET #1 — INTERPRET ANSI SPECIFICATIONS AND TCA GUIDELINES USED IN RENOVATING AND REPAIRING TILE INSTALLATIONS

NAME ______________________________ SCORE ____________

Proper installation techniques are required for renovation and repair procedures as with any tile job. Because of the unique surfaces encountered in renovation jobs, the tile setter must be particularly careful to follow ANSI specifications and TCA guidelines.

Use the *American National Standard Specifications for the Installation of Ceramic Tile* and TCA *Handbook for Ceramic Tile Installation* to answer the following questions about renovation and repair.

PART I — ANSI Specifications

A. What four methods may be used to prepare sound, crack free concrete or masonry wall for tile installation when the walls have been previously painted?

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

B. Who must expressly approve the installation of tile over an existing ceramic tile floor using dry-set or latex-portland cement mortar? ____________________

C. Can acid cleaners be used to clean glazed tiles? ____________________

D. In renovating a kitchen, which of the following counter top surfaces are dimensionally stable and may be tiled using an organic adhesive bond coat? Place an "X" beside each correct choice.

_____1. Particle board

_____2. Plastic laminate

_____3. Existing tile

_____4. Interior plywood

E. What procedure is required before using epoxy on plywood underlayment which has been contaminated? ____________________

____

____

____

ASSIGNMENT SHEET #1

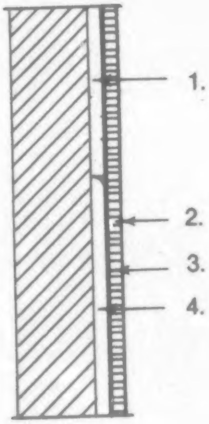
PART II — TCA Handbook

A. Name four backings suitable for renovation using dry-set or latex portland cement mortar.

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________

B. When replacing a shower receptor, what is the minimum distance above the curb the new waterproof membrane should extend? ________________ inches

C. Identify the materials shown in the diagram below.



1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________

D. Describe the recommended procedure to prepare the surface of existing tile for installation of new tile on floors.

____

____

____

____

ASSIGNMENT SHEET #1

E. What three methods are recommended for preparing concrete or masonry walls which are glossy, painted, or effloresced, or which have loose surface material prior to installing tile with dry-set mortar?

1. ______________________________

2. ______________________________

3. ______________________________

RENOVATION AND REPAIR
UNIT V

ASSIGNMENT SHEET #2 — INTERPRET LABELS OF PRODUCTS USED IN RENOVATING AND REPAIRING TILE INSTALLATIONS

NAME ______________________________ SCORE ______________

Using specific products as the manufacturer intended becomes even more critical in renovating and repairing tile installations. Many times customers have become particularly displeased with ceramic tile in general when their tile installations have proven unsatisfactory. The customers may ask more questions about the products you are using to make sure that the new work will endure the test of time and wear. Also, customers may ask for recommendations of tile care products.

PART I

Select any three tile products used in renovating and repairing tile installations. Complete the label information requested on the following pages.

ASSIGNMENT SHEET #2

A. LABEL INFORMATION

1. Type of product ____

____

2. Brand name ____

____

3. Manufacturer's name and address ____

____

____

4. Directions for use (amount to use and how to use) ____

____

____

____

____

5. Surfaces on which product can be used ____

____

6. Surfaces on which product should *not* be used ____

____

7. Caution statements ____

____

____

____

____

8. Net contents ____

____

____

____

ASSIGNMENT SHEET #2

9. List of ingredients ____________________

____

10. How would you explain this product and its use to a customer? ____________________

____

____

____

____

ASSIGNMENT SHEET #2

B. LABEL INFORMATION

1. Type of product
2. Brand name
3. Manufacturer's name and address
4. Directions for use (amount to use and how to use)
5. Surfaces on which product can be used
6. Surfaces on which product should *not* be used
7. Caution statements
8. Net contents

ASSIGNMENT SHEET #2

9. List of ingredients ____

____

10. How would you explain this product and its use to a customer? ______________

____

____

____

____

ASSIGNMENT SHEET #2

C. LABEL INFORMATION

1. Type of product
2. Brand name
3. Manufacturer's name and address
4. Directions for use (amount to use and how to use)
5. Surfaces on which product can be used
6. Surfaces on which product should *not* be used
7. Caution statements
8. Net contents

ASSIGNMENT SHEET #2

9. List of ingredients ______________________________

____

10. How would you explain this product and its use to a customer? ______________

____

____

____

____

ASSIGNMENT SHEET #2

PART II

Use the label on the following page to explain how you would recommend to a customer a product that will help maintain a tile installation.

ASSIGNMENT SHEET #2

#140

HILLYARD SUPER SHINE-ALL®

ORIGINAL SASSAFRAS

PRESERVES - CLEANS - POLISHES
ALL PURPOSE CLEANER
NEUTRAL CHEMICAL CONCENTRATE
Biodegradable and Phosphate Free
For Use On Any Type Surface Not Injured By Water

DIRECTIONS

General Cleaning – Use one cup of Super Shine-All to three gallons of water. Spread the solution on the surface to be cleaned, working an area of only one to two hundred square feet at a time. Allow time for grime dissolving action to take place. Squeegee, wet vacuum, mop or wipe up dirt-laden solution. Keep floor wet at all times during the cleaning operation to prevent dissolved soil from drying back on the floor. For extremely dirty or oily surfaces increase the amount of Super Shine-All and use hot water if available.

Super Shine-All provides a protective sheen to preserve and protect the surface. Therefore, it is better not to rinse after normal cleaning. When preparing a surface to receive paint, finish, etc., rinse with clear water after scrubbing.

In food processing areas, rinse thoroughly with clean water.

Special Cleaning – For unusual and difficult cleaning problems, call on your Hillyard Maintaineer. "He is on your staff -- not your payroll."

UL CLASSIFIED BY UNDERWRITERS LABORATORIES, INC ® AS TO SLIP RESISTANCE ONLY. 186S.

THE SECRET OF SUPER SHINE-ALL . . . and its amazing ability to clean the dirt off any surface, lies in its six-fold action:

- WETTING -- Reduces surface tension, makes the cleaning water wetter, better able to soak into the soil.
- PENETRATING -- Gets into and under the dirt, lifts it up off the surface.
- SUDSING -- Plenty of rich suds for thorough cleansing.
- DISSOLVING -- Breaks up water soluble substances in the dirt.
- EMULSIFYING -- Breaks up grease and oil in the dirt, into tiny particles that are suspended in the cleaning solution.
- SUSPENDING -- Holds ALL soil particles in the cleaning liquid, for quick and thorough pick up. Normally, no rinsing is necessary!

Manufactured by **HILLYARD CHEMICAL COMPANY**, St. Joseph, Missouri 64502 U.S.A. **680**

RENOVATION AND SKILLS
UNIT V

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

(NOTE: Answers are taken from ANSI A108-1976 and *1983 Handbook for Ceramic Tile Installation.* Use of other editions may lead to answers different than those given here.)

PART I

A. (In any order, AN-2.5.1.2.2)

1. Sandblasting
2. Chipping
3. Scarifying
4. Metal lath

B. Mortar manufacturer (AN-2.6.2.2)

C. No (A-3.5.2)

D. 2, 3 (AN-2.6.3.2 and AN-2.6.3.3; see A-4.2.2)

E. Sand to expose raw wood (A-3.1.4.3.3)

PART II

A. (Any four of the following, TR911-83)

1. Portland cement plaster
2. Concrete
3. Concrete masonry
4. Structural clay tile
5. Brick
6. Glass mesh mortar units
7. Gypsum board

B. 3" (TR914-83)

ANSWERS TO ASSIGNMENT SHEETS

C. Case IV (TR913-83)

D. Remove soap scum, wax coatings, oil, etc. from existing tile surfaces. Mechanical abrasion with a Carborundum disk followed by a clear water wash is recommended. Other cleaning methods involve use of soapless detergents, commercial tile cleaning, and, in special cases, solvents or acid. Solvents and acids should be used with care and only when necessary because of their hazardous nature. Installation must be thoroughly rinsed and dry before setting the new tile (TR912-83)

E. (In any order, TR911-83)

  1. Sandblasting
  2. Chipping
  3. Scarifying

Assignment Sheet #2 — Evaluated to the satisfaction of the instructor

RENOVATION AND REPAIR
UNIT V

JOB SHEET #1 — REPLACE LOOSE OR DAMAGED TILE

I. Tools and materials

   A. Tools

      1. Grout saw
      2. Gauging trowel
      3. Razor blade knife
      4. Electric drill
      5. Carbide-tipped bit
      6. Eye protection
      7. Carbide-tipped chisels, 1/4" and 3/8"
      8. Putty knife
      9. Margin trowel
      10. Beating block
      11. Rubber mallet
      12. Sponges
      13. Joint striking tool
      14. Clean terry cloth towel
      15. Rubber grouting trowel
      16. Pails
      17. Claw hammer

   B. Materials

      1. Mortar or adhesive suitable for installation
      2. Source of clean, potable water
      3. Commercial portland cement grout

4. Latex additive

5. Replacement tile

II. Procedure to remove tile from cement or cement-mortared backing

A. Put on eye protection

B. Carefully remove old grout all the way around tile that is to be replaced

C. Using drill with a 1/4" carbide-tipped bit, drill several holes in center of tile

(CAUTION: Drill slowly and only through tile.)

D. Place chisel on tile and tap lightly with hammer to chip out small pieces of old tile

(NOTE: Remove enough of the old setting material to permit flush installation. Because the bond on these materials is so strong, trying to chip away the old setting material may ruin or damage the backup surface.)

(CAUTION: Take care not to damage the backup surface.)

III. Procedure to remove tile from gypsum wallboard

A. Put on eye protection

B. Carefully remove old grout all the way around tile that is to be replaced

C. Cut around tile and through first layer of wallboard paper with razor blade knife

D. Pull tile and paper off

(NOTE: The setting material will come off with paper. Once first tile has been removed, others can be easily removed.)

IV. Procedure to replace tile

A. Clean grout from edges of tiles that border the tile that was removed

B. Using margin trowel, butter the back of replacement tile 100 percent with mortar or adhesive; press, twist, and beat firmly into place

C. Apply new grout, using your finger or rubber grouting trowel to force grout into joints; clean with a damp sponge

D. Strike grout joints if joints are 1/8" or less, leaving a smooth finish

E. Polish with clean, soft cloths after haze appears

RENOVATION AND REPAIR
UNIT V

JOB SHEET #2 — REPLACE DAMAGED BATHROOM ACCESSORIES

I. Tools and materials

A. Replacement accessories

B. Gauging trowel

C. Carbide-tipped chisel

D. Eye protection

E. Margin trowel

F. Claw hammer

G. Razor blade knife

H. Hacksaw

I. Mortar or adhesive suitable for installation

J. Grout to match existing grout

K. Sponges

L. Masking tape

M. Source of clean, potable water

N. Pails

O. Wire mesh

P. Electric drill and carbide bit

Q. Screwdriver

II. Procedure for replacing damaged soap dish

(NOTE: Materials and Methods Standards Association Bulletin #8 provides helpful information on accessory installations.)

A. Put on eye protection

B. Use chisel and hammer to carefully remove damaged accessory a piece at a time

JOB SHEET #2

C. Clean backup wall, removing all old grout and setting material from area to receive new accessory

D. Mix small amount of mortar if used, following manufacturer's directions

(NOTE: Mortar should be a very stiff, no-slump mix.)

E. If replacing recessed fixture, shape wire mesh into a basket and insert into hole

F. Fill wire basket with enough mortar to allow 100 percent coverage of the back of the fixture

G. If fixture is flanged, butter around flange of fixture and around edges of hole

H. Press soap dish firmly into mortar, making sure that pressure is applied evenly

I. If previous fixture was surface-type, make holes in wall with drill

(NOTE: A carbide-tipped chisel may be used if backing is glass mesh mortar unit.)

J. Using margin trowel, butter 100 percent of back of new accessory with setting material; press and twist firmly into place

K. Use a damp sponge to clean off excess mortar

L. Tape accessory in place with masking tape; allow to cure for twenty-four hours

M. Mix small amount of grout, following manufacturer's directions

N. Grout around accessory

(NOTE: Applying elastomeric sealant with a dampened finger may be desirable for this procedure.)

O. Clean area with damp sponge

P. Leave word that accessory is not to be used for several days

RENOVATION AND REPAIR
UNIT V

JOB SHEET #3 — REPLACE GROUT

I. Tools and materials

A. Grout to match existing grout

(NOTE: Use the same color grout that was used in the original installation. Choose a grout suitable for area. See *1982 Handbook for Ceramic Tile Installation*, pp. 7 and 10.)

B. Grout saw or razor blade knife

C. Pail

D. Sponges

E. Carbide-tipped chisel

F. Terry cloth towel

G. Nylon scouring pad

H. Joint striking tool

I. Latex additive

J. Eye protection

K. Rubber grouting trowel

L. Materials for barricade

M. Source of clean, potable water

N. Vacuum cleaner

O. Carbide-tipped scoring tool

P. Gauging trowel

Q. Margin trowel

JOB SHEET #3

II. Procedure

(CAUTION: To prevent damage to tiled surface, great care must be taken in removing grout.)

A. Put on eye protection

B. Remove damaged grout

C. Use vacuum or damp sponge to remove small pieces of grout from joints

D. Mix grout with latex additive, following manufacturer's directions

(NOTE: Always add powder to liquid; not liquid to powder.)

E. Force new grout well into joints, using your finger or the rubber grouting trowel

F. Strike joint(s) if 1/8" wide or less

G. Use a damp sponge to clean surface of excess grout and to smooth joints or use damp terry cloth towel if joint is over 1/8"

H. Use clean terry cloth to remove haze if it appears as tile dries

RENOVATION AND REPAIR
UNIT V

JOB SHEET #4 — CLEAN AGED TILE

I. Tools and materials

  A. White vinegar

  B. Source of hot water

  C. Pail

  D. Clean terry cloth towel

  E. Household cleaner

  (NOTE: Avoid use of cleaners that contain strong acid.)

  F. Nylon scouring pads

  G. Commercial industry cleaner

  H. Sodium hypochlorite (chlorine bleach)

  I. Cleaning tools required for surface

  EXAMPLES: Broom, mop, sponges

II. Procedure for removing mineral deposits

  A. Sweep or dust surface

  B. Scrub or mop tiles with vinegar or commercial industry cleaner

  (CAUTION: Never use steel wool pads. They will leave rust on the wall, especially in the grout joints.)

  C. Rinse well after cleaning with water

  D. Dry with clean, soft cloth

III. Procedure for removing organic buildup

  A. Mix a solution of a good household cleaner and hot water

  (NOTE: Use sodium hypochlorite to remove mildew.)

  B. Use nylon scouring pad to scrub tiles well

  (CAUTION: Never use steel wool pads. They will leave rust on the wall, especially in the grout joints.)

  C. Rinse well and dry

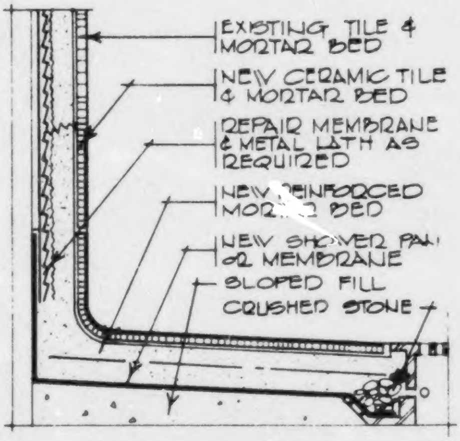
RENOVATION AND REPAIR
UNIT V

JOB SHEET #5 — REMOVE AND REPLACE SHOWER FLOOR AND BASE

I. Detail and guidelines from TCA *Handbook* (Figure 3)

FIGURE 3

Cement Mortar **TR914-82**


EXISTING TILE & MORTAR BED
NEW CERAMIC TILE & MORTAR BED
REPAIR MEMBRANE & METAL LATH AS REQUIRED
NEW REINFORCED MORTAR BED
NEW SHOWER PAN OR MEMBRANE
SLOPED FILL
CRUSHED STONE

Recommended Uses:
- over wood or concrete subfloors; where old shower-pan has failed.

Requirements:
- remove existing shower receptor, waterproof membrane and wall tile as required to install new waterproof membrane.
- replace any damaged wall or floor substrate materials.
- slope required in new membrane ¼" per foot to weep holes in drain.
- new membrane to turn up wall at least 3" above shower curb.

Materials and Installation:
- shower receptor, see Methods B414 or B415.
- mortar bed walls, see Methods W222, W231, or W241.

JOB SHEET #5

(NOTE: When removing a shower floor, always remove the base and at least one row of tiles above the base. The instructions in this job sheet are pertinent to the removal and replacement of shower floor and base that were originally installed with conventional [thick-bed] mortar.)

II. Tools and materials

  A. Tools

    1. Carbide-tipped chisels, 1/4" and 3/8"
    2. Hammer
    3. Tin snips
    4. Razor blade knife
    5. Mortar box
    6. Gauging trowel
    7. Margin trowel
    8. Steel measuring tape or wood folding rule
    9. Sponges
    10. Beating block
    11. Rubber grouting trowel
    12. Rubber mallet
    13. Square-edged shovel
    14. Mortar hoe
    15. Clean terry cloth towels
    16. Straightedges
    17. Pails
    18. Nippers
    19. Eye protection
    20. Straight boards

JOB SHEET #5

21. Level (18")
22. Tile cutter
23. Electric drill
24. Carbide drill bit, 1/4"
25. Claw hammer
26. Cement trowel
27. Vacuum cleaner
28. Drain plug

B. Materials

1. Replacement tiles (amount needed to complete job)
2. Base pieces (amount needed to complete job)
3. Waterproof membrane
4. Silicone sealant
5. Portland cement (1 sack)
6. Fine masonry sand (1 sack)
7. Coarse gravel (handful)
8. Grout (to match existing grout)
9. Dry-set mortar
10. Source of clean, potable water
11. Material for barricade
12. Wire mesh
13. Hydrated lime

III. Procedure to test for leaks

A. Test drain seal for leaks

1. Remove tiles around drain
2. Pour small amount of water around drain

JOB SHEET #5

- B. If drain leaks, reseal drain
  1. Remove clamping ring
  2. Apply sealant
  3. Replace clamping ring
  4. Test again for leaks to ensure good repair

     (NOTE: Often the leak is at the clamping ring at the drain because the ring was not sealed properly. Therefore, tile should always be removed from around the drain before removing the entire floor and base. If leak is determined not to be at this location, then complete removal of floor and base are necessary.)
- C. Test membrane for leaks
  1. Install drain plug
  2. Fill shower floor with water
  3. Let water stand for twenty-four hours
  4. Check for leaks

     (NOTE: If leak has been repaired, no other work is required. Simply remove the drain plug and replace the tiles around the drain. If leak has not been repaired, continue procedure.)

IV. Procedure to remove base

- A. Stuff drain with paper to prevent clogging with chipped debris
- B. Put on eye protection
- C. Remove remaining floor tiles
  1. Examine floor for leaks as tile is removed
  2. If leak is detected, repair membrane and replace tile
- D. Use chisel and hammer to carefully chip base and first row of tiles from walls
- E. Cut through backing board all the way back to studs with chisel (See Figure 4.)
  1. Cut through the mortar halfway up the first row of wall tile

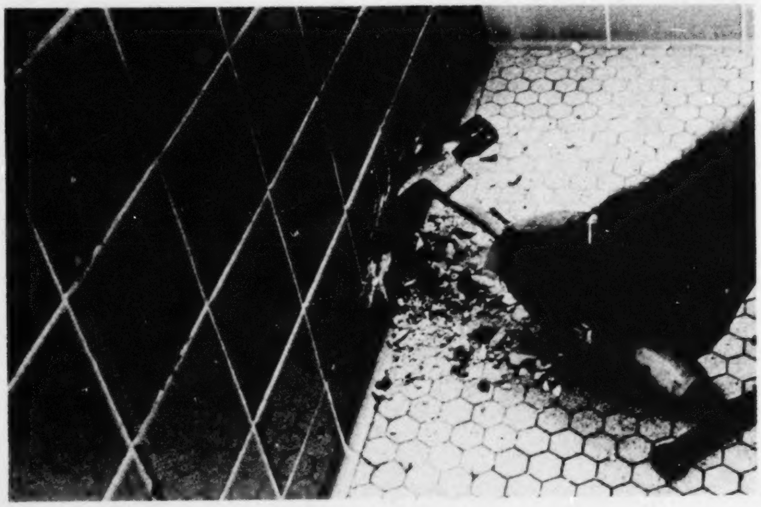
     (NOTE: Cutting halfway up the first row of tile allows new tiles to be joined on firm wall surface rather than at place where wall was cut.)

JOB SHEET #5

2. Keep the cut as level as possible

3. Cut through the metal lath, if mortar wall

FIGURE 4

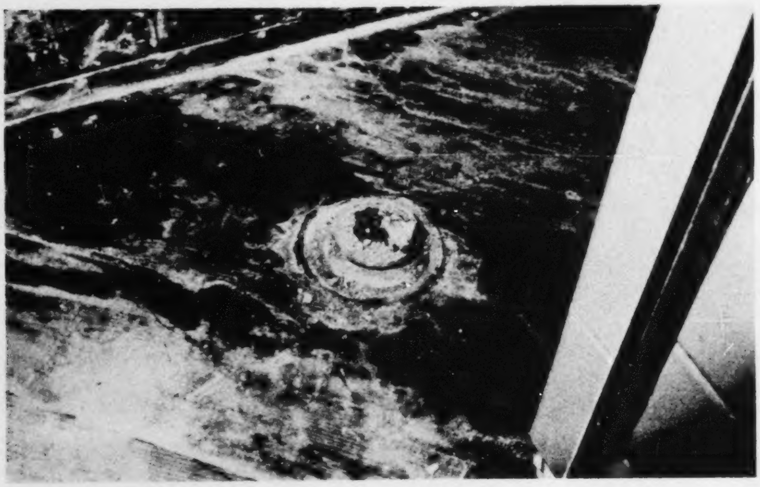


F. Chip out mortar until reaching the original waterproof membrane

G. Remove clamping ring from drain and old membrane (Figure 5)

(NOTE: Check to see that subfloor is sloped to drain. If it is not, slope according to TCA *Handbook* guidelines.)

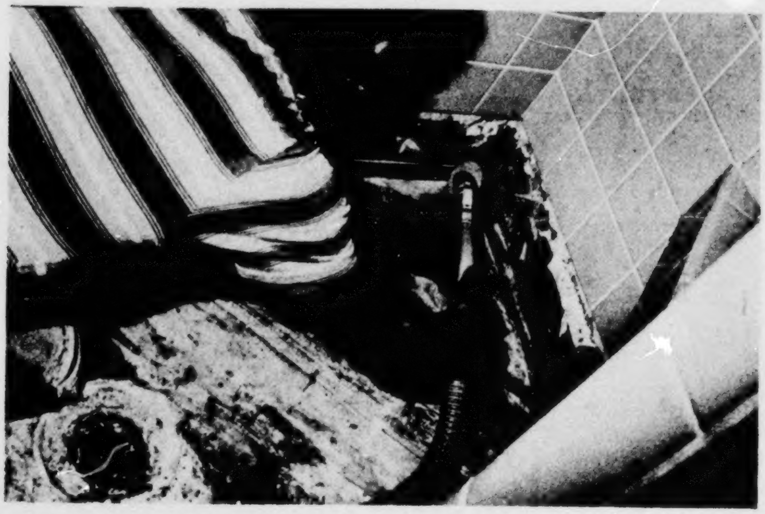
FIGURE 5



JOB SHEET #5

H. Vacuum floor thoroughly to remove any small chips that may puncture membrane (Figure 6)

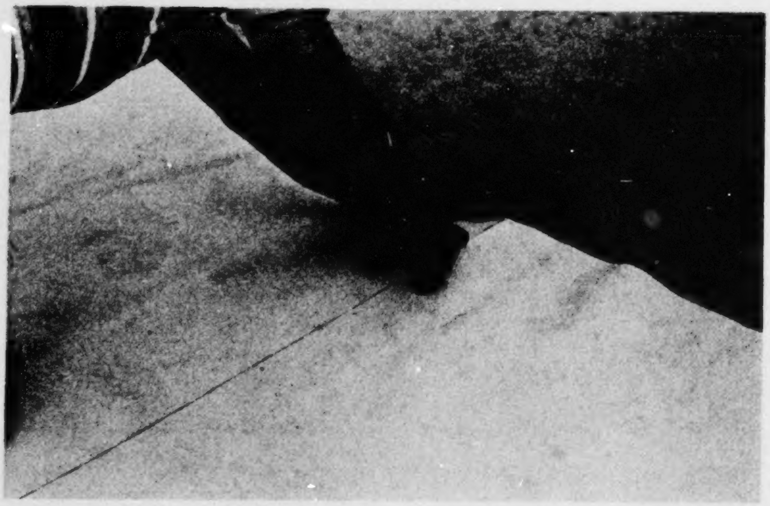
FIGURE 6



I. Install new waterproof membrane, following manufacturer's instructions

1. Cut membrane large enough to cover floor and lap wall at least six inches (Figure 7)

FIGURE 7

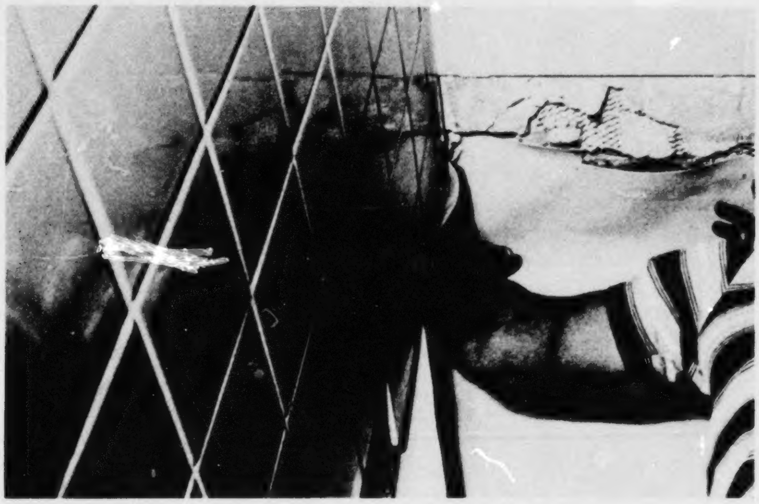


JOB SHEET #5

2. Fold corners well into bottom and up wall to at least three inches above shower curb (Figure 8)

   (NOTE: Do not cut the corners. Nail the membrane only at top edge. Local codes may require protection against water penetration at junction of shower opening and curb.)

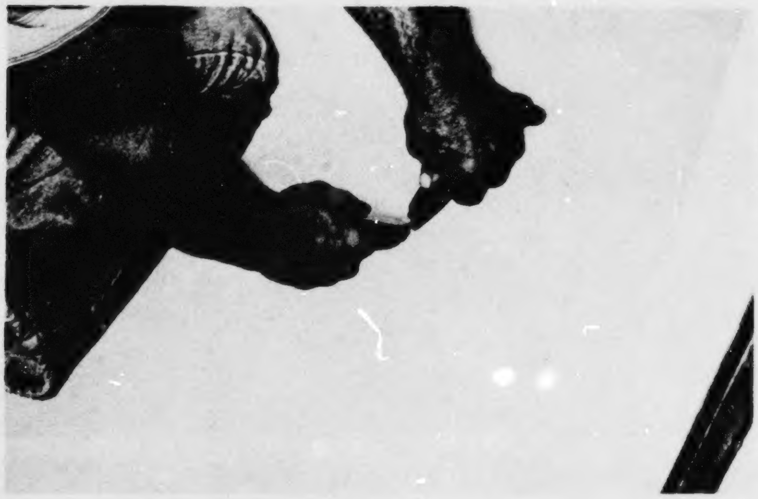
FIGURE 8



J. Cut the hole for drain with razor blade knife (Figure 9)

(NOTE: Make hole just large enough to fit the drain pipe.)

FIGURE 9

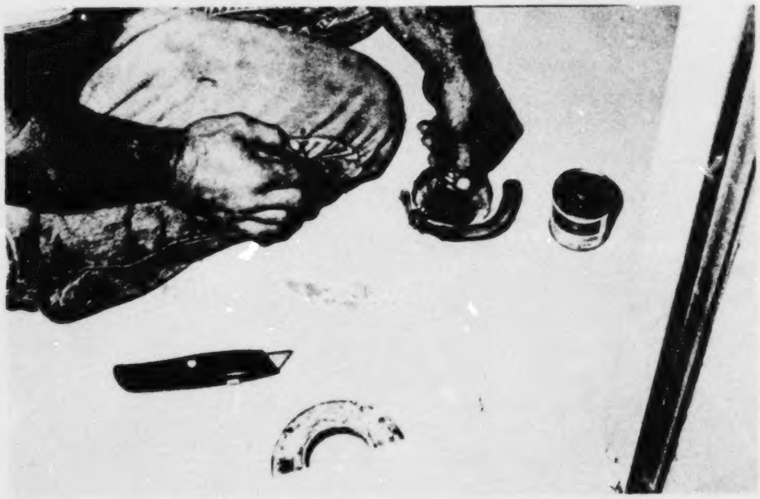


JOB SHEET #5

K. Seal bottom and top of membrane around drain with silicone sealant (Figure 10)

(NOTE: Be sure top and bottom of membrane are well sealed.)

FIGURE 10



L. Screw the large flange onto the membrane

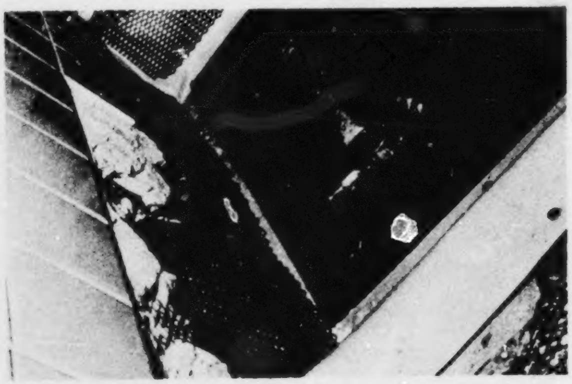
M. Test membrane for leakage

N. Place sheets of cardboard over membrane to protect it from punctures

(NOTE: Flattened tile box tops may be used.)

O. Cut strips of metal lath, and carefully fasten over membrane on walls; hold lath in place by wedging it between floor and place in wall mortar that has been chiseled out (Figure 11)

FIGURE 11



JOB SHEET #5

P. Mix wall mortar

1. Mix one part portland cement, one-half part hydrated lime, and five parts damp sand

2. Add clean water and stir to stiff, no-slump mixture

Q. Using cement trowel, spread mortar on wall over metal lath

R. Trowel and screed flush with original wall mortar and allow to set for one or two hours before building screed

S. Mix screed

T. Build a screed around walls to base line

1. Measure down one tile plus base from original tile, and build screed to this level

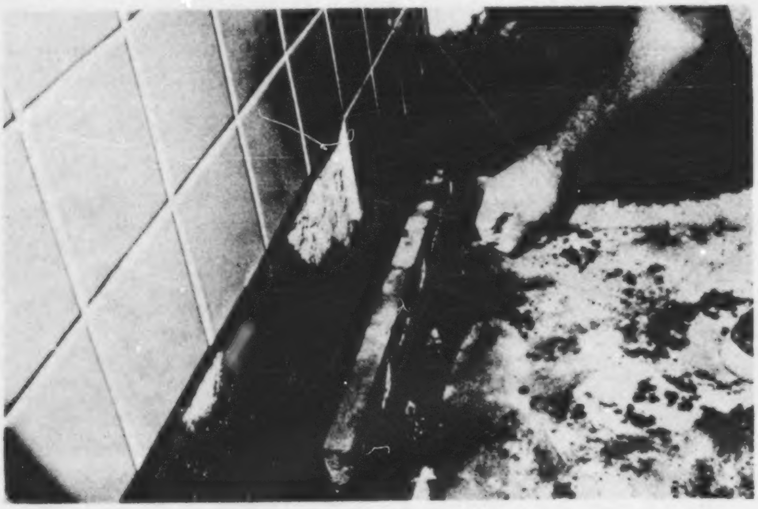
   (NOTE: Screed should be parallel with horizontal joints in original field.)

2. Under level used as straightedge, pack screed mortar using cement or gauging trowel width of level

   (NOTE: Take care not to damage the membrane; it must remain watertight.)

3. Cut off screed square to wall with trowel (Figure 12)

FIGURE 12

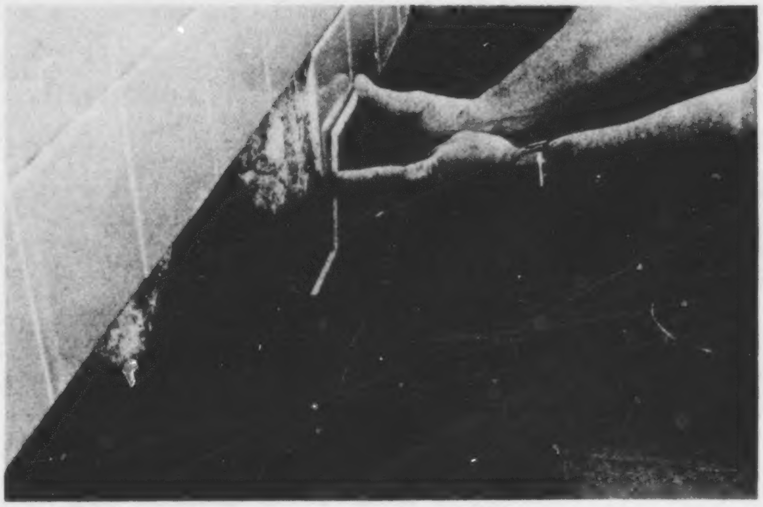


JOB SHEET #5

4. Check screed in several places with a loose tile and a piece of loose base to be sure that replacement base and tiles will fit (Figure 13)

   (NOTE: Screed should be parallel with horizontal joints in original field.)

FIGURE 13

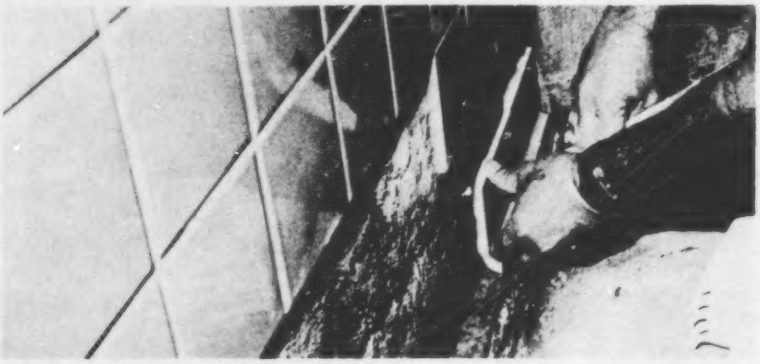


U. Clean tools and area; barricade, and let mortar set for at least twenty-four hours

V. Mix dry-set mortar, following manufacturer's directions

W. Using margin or gauging trowel, butter 100 percent of the back of each base piece with dry-set mortar; press and twist firmly into place on top of screed (Figure 14)

FIGURE 14



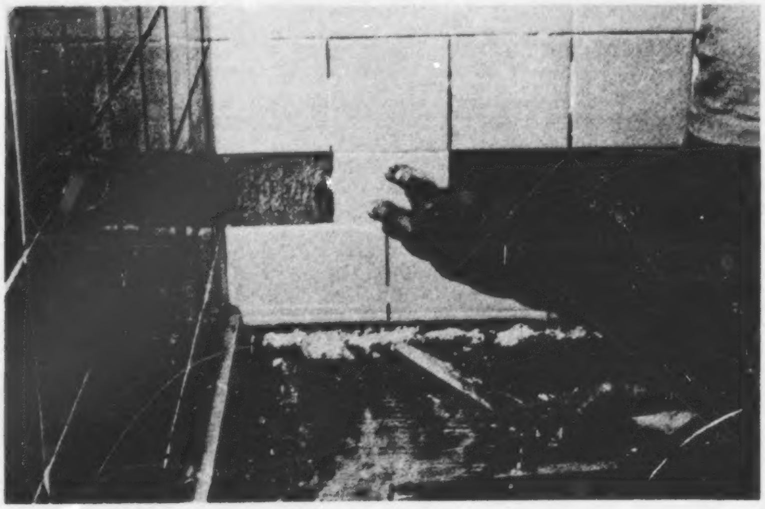
JOB SHEET #5

X. Miter inside corners if necessary (Figure 15)

FIGURE 15

Y. Using margin or gauging trowel, butter 100 percent of the back of each wall tile; press and twist firmly into place, taking care to match existing vertical joints (Figure 16)

FIGURE 16



JOB SHEET #5

Z. Use a damp sponge to keep surfaces of tile clean and to keep mortar out of joints

AA. Beat base and wall tiles well into mortar with beating block and rubber mallet, making flush with existing plane of old tile

BB. Clean tile joints of all mortar

V. Procedure for mixing mortar for the shower floor

A. Mix four parts fine masonry sand and one part portland cement in mortar mixing box

(NOTE: Put sand in box first, then add cement.)

B. Mix with mortar mixing hoe, pulling mixture to one end of box and then reversing the procedure

C. Level out mixture and make small troughs in top to hold water

D. Add water slowly until a firm mix is obtained

(NOTE: This mix should be firm like damp clay that will mold and hold its shape. It should not be too wet.)

VI. Procedure for applying mortar to shower floor

A. Remove cardboard that you placed on membrane earlier to protect it

B. Plug drain and pour water on membrane to check for leaks

(NOTE: Repair membrane if required.)

C. Remove plug and drain water

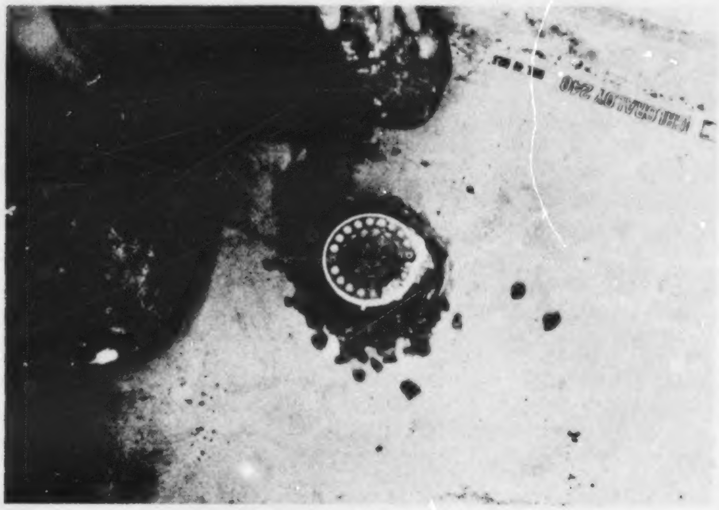
D. Adjust drain so that there is a minimum of 1 1/4" from membrane to top of drain; figure slope to drain

(NOTE: The slope to the drain should be a minimum of 1/4" to a maximum of 1/2" per foot.)

JOB SHEET #5

E. Place gravel or tile chips around drain at weep holes (Figure 17)

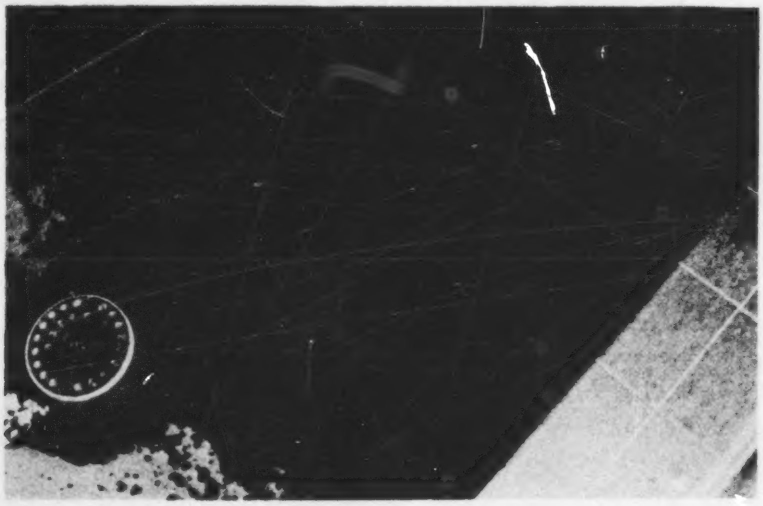
FIGURE 17



F. Carry mortar to shower in pail and dump on floor

G. Spread mortar to approximately half of depth needed (Figure 18)

FIGURE 18



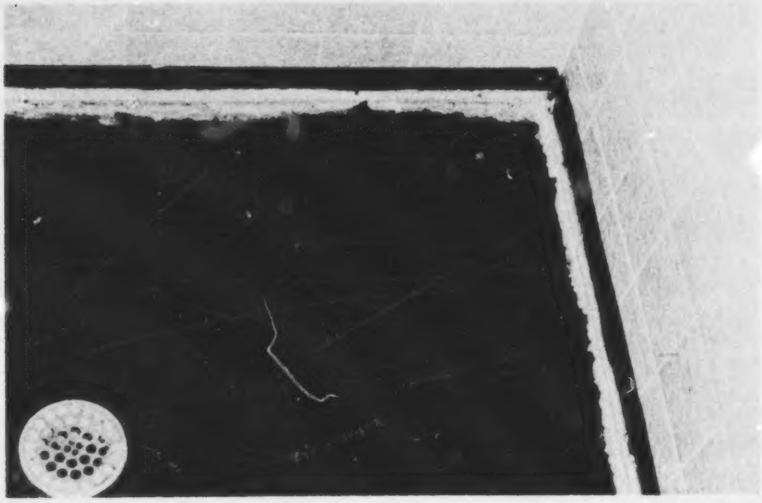
JOB SHEET #5

H. Spread evenly and tamp and compact with trowel or beating block

I. Cut a piece of wire mesh a little smaller than floor and embed it about halfway into mortar (Figure 19)

(NOTE: Cut hole in mesh for drain. Tape may be applied to base tile to protect it.)

FIGURE 19



J. Firmly pack mortar with back of trowel to embed wire mesh

K. Run notched edge of straightedge on top part of base radius to slant mortar to drain

(NOTE: This is done to make the floor tile slope from the base to the drain. Be sure this mortar surface is smooth all the way to the drain. There can be no low or high places.)

(CAUTION: All mortar must be packed well, especially in corners and around drain.)

L. Sprinkle approximately $^1/_{16}$" pure portland cement over surface of mortar

M. Work cement out uniformly; sprinkle a little water on top

(NOTE: The floor is now ready to receive tile.)

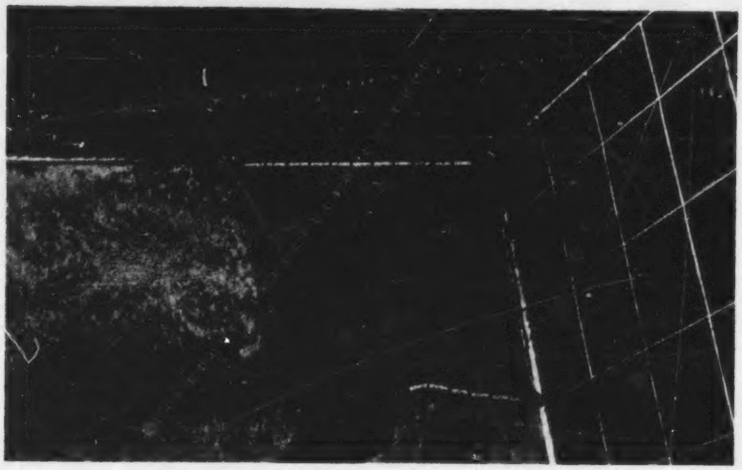
JOB SHEET #5

VII. Procedure for installing shower floor

A. Install sheets of floor tile, beginning against base at inside corner farthest from door (Figure 20)

(CAUTION: Tile manufacturers must specify whether back-mounted tile assemblies are suitable in wet areas.)

FIGURE 20

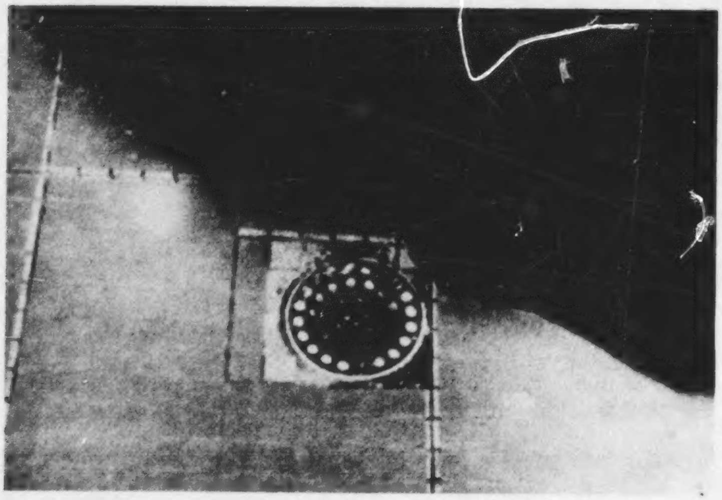


B. Install several sheets and make cuts at wall

(NOTE: These sheets can be cut with a razor blade knife.)

C. Remove as many tiles around drain as necessary (Figure 21)

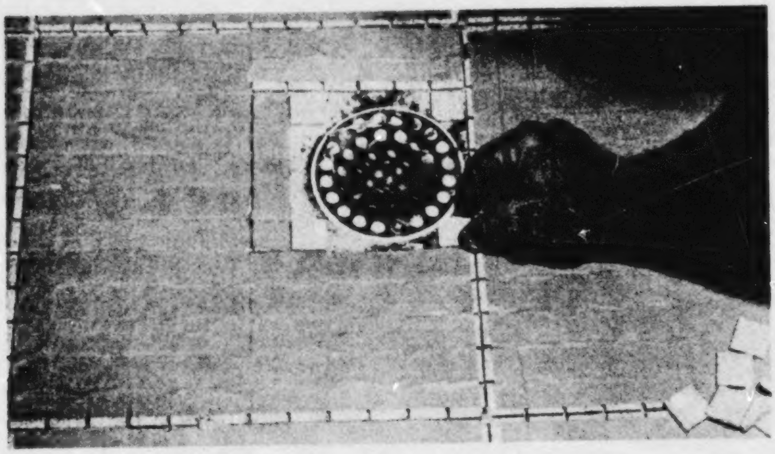
FIGURE 21



JOB SHEET #5

D. Cut individual pieces from a sheet and install these around drain (Figure 22)

FIGURE 22



E. Beat well into mortar with beating block or rubber mallet, making sure tile is flush with drain and base

(NOTE: Try not to put any weight on the floor.)

F. Use damp sponge to clean floor tile surfaces

G. Clean work area and remove all waste

H. Barricade shower entrance for at least seventy-two hours before grouting

I. Clean out mortar mixing box with water

VIII. Procedure for grouting

A. Mix grout with water following manufacturer's directions

B. Mix well until mixture reaches a smooth, no-slump consistency

C. Let stand for fifteen minutes

D. Remix

(CAUTION: Do not add additional powder or liquid.)

E. Grout base and floor with appropriate grout for each, moving rubber grouting trowel in circles, working grout well into joints

F. Remove excess grout with rubber grouting trowel

JOB SHEET #5

G. Fill five-gallon pail with clean water

H. Clean all excess grout from newly grouted area with sponge or cheesecloth pad, rinsing sponge or pad frequently in pail and wringing out damp

(NOTE: Change water in pail frequently to keep it clean.)

I. Cover newly installed wall and floor area with kraft paper and allow to damp cure for seventy-two hours

J. Clean tools and work area, barricade shower, and leave word not to use for seventy-two hours

RENOVATION AND REPAIR
UNIT V

JOB SHEET #6 — REMOVE AND REPLACE EXISTING BACKING MATERIALS IN WET AREA

(NOTE: If the customer is changing all the tile, it is easier and less expensive to remove all the existing backing board and to apply new backing material.)

I. Tools and materials

  A. Glass mesh mortar units
  B. Cement trowel
  C. Galvanized roofing nails (1 1/2" to 2" long, preferably screw-type)
  D. Carbide-tipped scoring tool
  E. Straightedges
  F. Razor blade knife
  G. Hammer
  H. Chisels
  I. Broom
  J. Dustpan
  K. Pail
  L. Buckets for removing debris
  M. Dry-set mortar
  N. Coated fiberglass tape (2" wide)
  O. Padding to protect tub

II. Procedure

  A. Protect tub carefully to keep from chipping it with falling tile if installation is over tub
  B. Cut through existing wall with razor blade knife
  C. Remove backing and tile

JOB SHEET #6

D. Replace original wall with glass mesh mortar units

1. Measure area to be replaced
2. Transfer measurements to glass mesh mortar units
3. Score and snap glass mesh mortar units to desired dimensions (Figures 23 and 24)

FIGURE 23

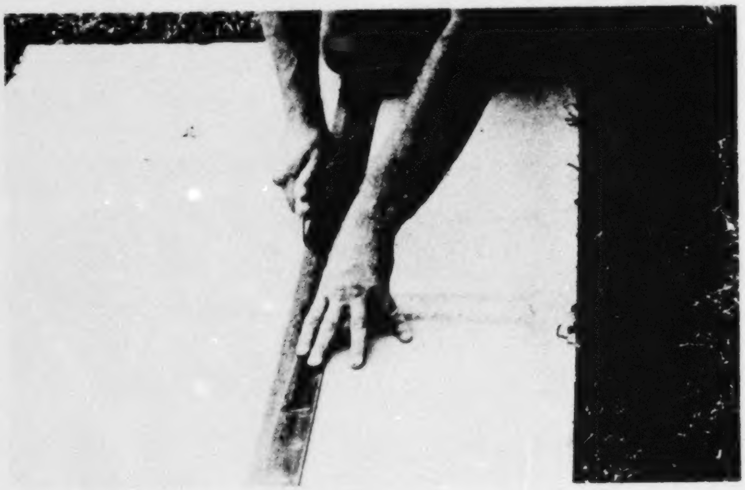
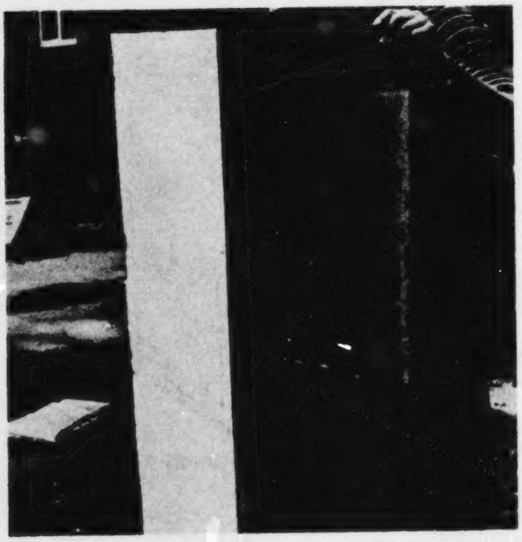


FIGURE 24



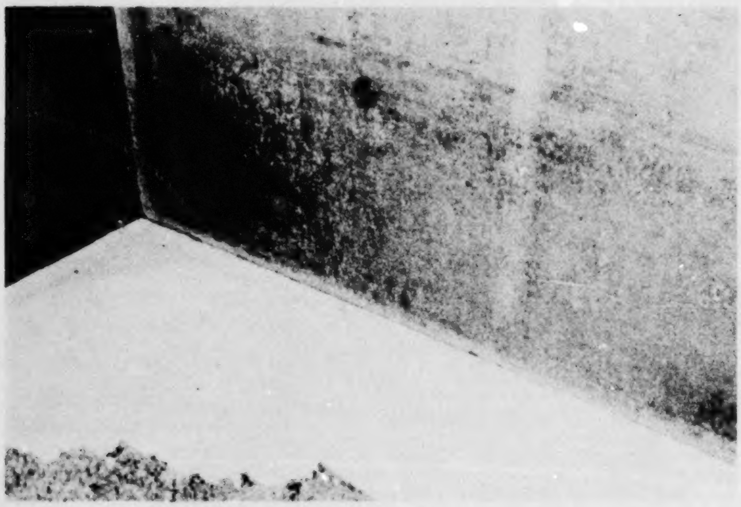
JOB SHEET #6

4. Cut holes for water pipes and controls with chisel and hammer

5. Place units solidly on tub lip, if installation is over tub (Figure 25)

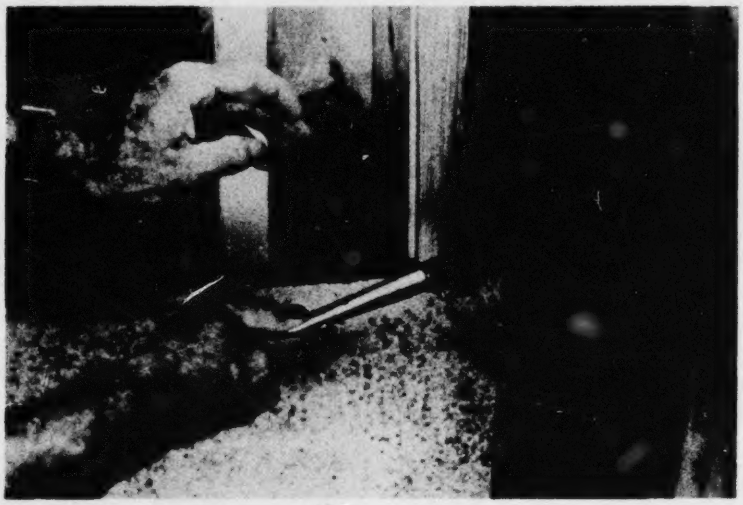
(NOTE: Begin installation with back wall for tub surround.)

FIGURE 25



6. Nail units to studs at six-inch intervals with galvanized roofing nails, making sure that space between units is 1/8" to 3/16" wide (Figure 26)

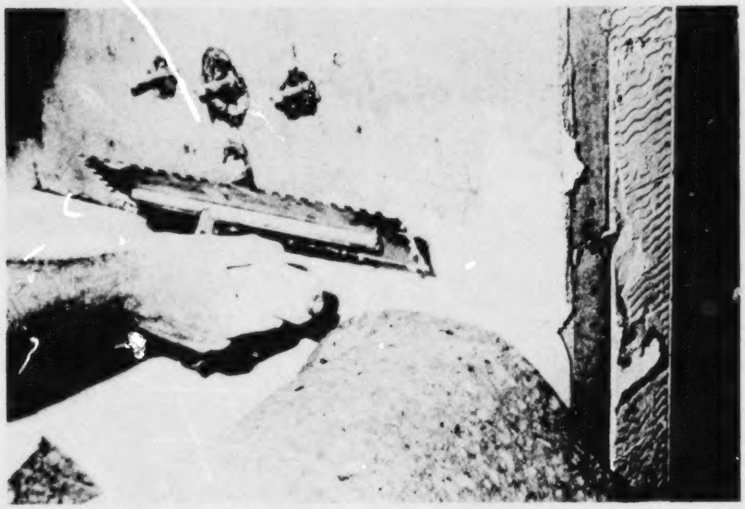
FIGURE 26



JOB SHEET #6

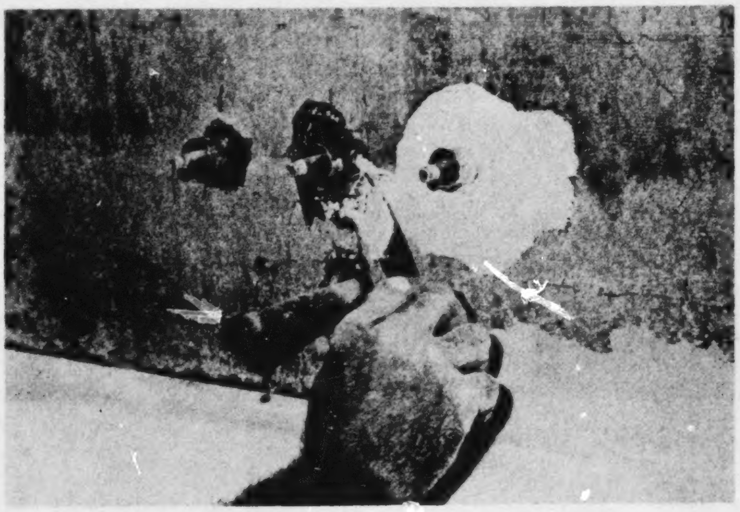
7. Fill gap between tub and glass mesh mortar units solid with dry-set mortar (Figure 27)

FIGURE 27



8. Pack around water pipes and controls with dry-set mortar (Figure 28)

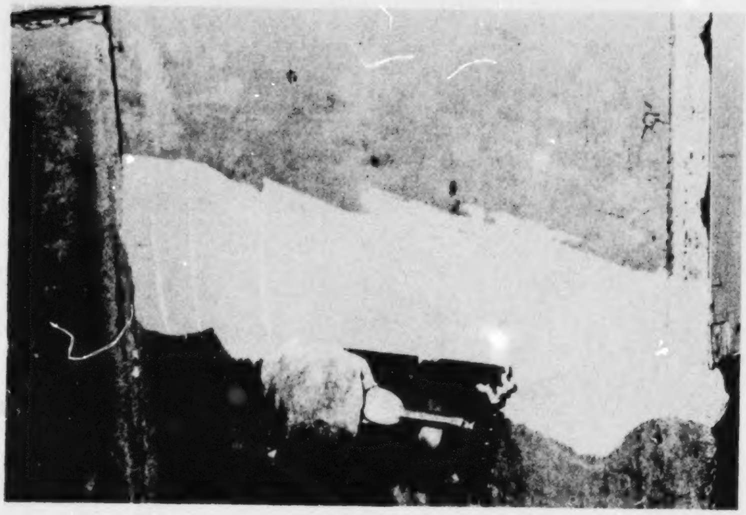
FIGURE 28



JOB SHEET #6

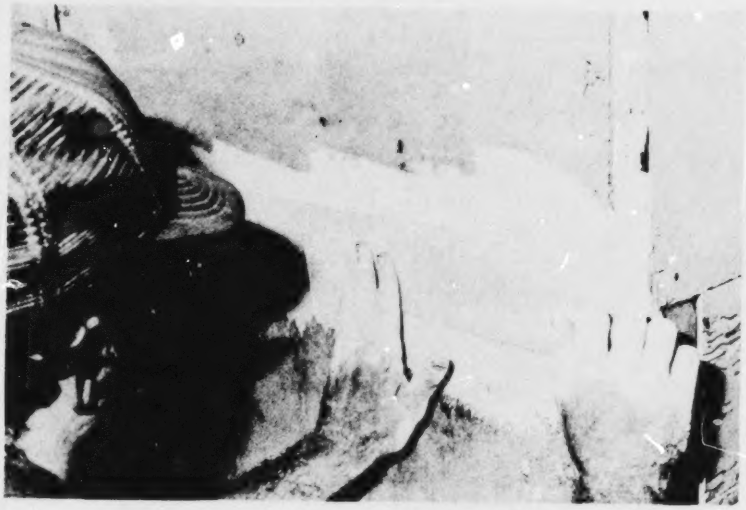
9. Fill all vertical, horizontal, and corner joints in glass mesh mortar units solid with dry-set mortar (Figure 29)

FIGURE 29



10. Embed two-inch wide fiberglass tape in dry-set mortar over joints; trowel seam smooth and flush over tape (Figure 30)

FIGURE 30



(NOTE: Tile installation is completed as for new installation.)

RENOVATION AND REPAIR
UNIT V

JOB SHEET #7 — REMOVE AND REPLACE BACKING MATERIALS IN A DRY AREA

I. Tools and materials

A. New backing material (gypsum board)

B. Drywall nails

C. Chisel

D. Razor blade knife

E. Hammer

F. Broom

G. Dustpan

H. Buckets for removing debris

I. Current *Recommended Specifications For the Application and Finishing of Gypsum Board.*

II. Procedure

A. Cut through existing wall at top of original cap with a razor blade knife

B. Remove backing and tile

C. Replace original wall with new gypsum board of same thickness as original wall

(NOTE: Board should be installed to minimize horizontal seams.)

D. Decide if you are going to install block or tape at horizontal joints per *GA-216* instructions 15.2

E. Nail board to wall studs at six-inch intervals

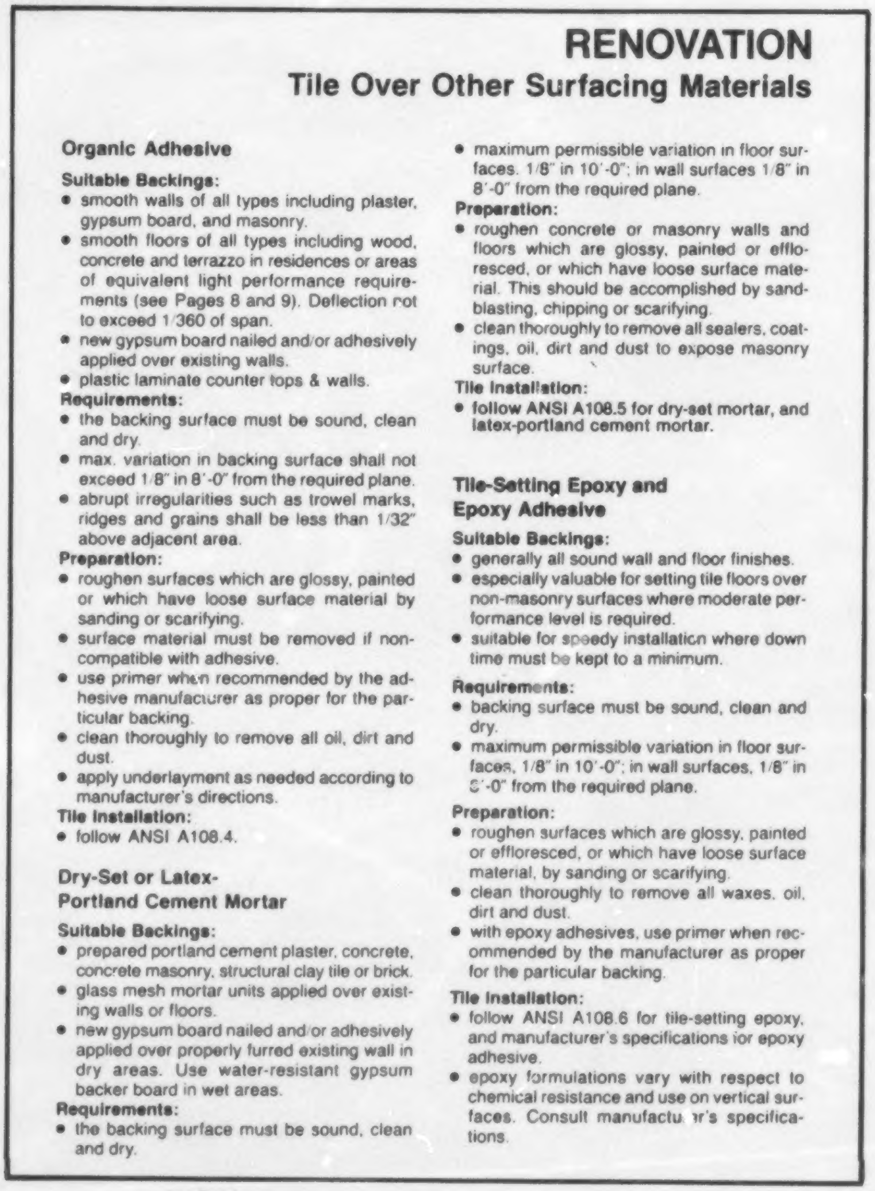
(NOTE: New tile will begin just above or one tile higher than original, and cap will be added. Installation is completed as if for new installation.)

RENOVATION AND REPAIR
UNIT V

JOB SHEET #8 — INSTALL CERAMIC TILE OVER LAMINATED COUNTER TOP AND BACKSPLASH

I. Guidelines from TCA *Handbook* (Figure 31)

FIGURE 31



RENOVATION
Tile Over Other Surfacing Materials

Organic Adhesive

Suitable Backings:
- smooth walls of all types including plaster, gypsum board, and masonry.
- smooth floors of all types including wood, concrete and terrazzo in residences or areas of equivalent light performance requirements (see Pages 8 and 9). Deflection not to exceed 1/360 of span.
- new gypsum board nailed and/or adhesively applied over existing walls.
- plastic laminate counter tops & walls.

Requirements:
- the backing surface must be sound, clean and dry.
- max. variation in backing surface shall not exceed 1/8" in 8'-0" from the required plane.
- abrupt irregularities such as trowel marks, ridges and grains shall be less than 1/32" above adjacent area.

Preparation:
- roughen surfaces which are glossy, painted or which have loose surface material by sanding or scarifying.
- surface material must be removed if non-compatible with adhesive.
- use primer when recommended by the adhesive manufacturer as proper for the particular backing.
- clean thoroughly to remove all oil, dirt and dust.
- apply underlayment as needed according to manufacturer's directions.

Tile Installation:
- follow ANSI A108.4.

Dry-Set or Latex-Portland Cement Mortar

Suitable Backings:
- prepared portland cement plaster, concrete, concrete masonry, structural clay tile or brick.
- glass mesh mortar units applied over existing walls or floors.
- new gypsum board nailed and/or adhesively applied over properly furred existing wall in dry areas. Use water-resistant gypsum backer board in wet areas.

Requirements:
- the backing surface must be sound, clean and dry.
- maximum permissible variation in floor surfaces. 1/8" in 10'-0"; in wall surfaces 1/8" in 8'-0" from the required plane.

Preparation:
- roughen concrete or masonry walls and floors which are glossy, painted or effloresced, or which have loose surface material. This should be accomplished by sandblasting, chipping or scarifying.
- clean thoroughly to remove all sealers, coatings, oil, dirt and dust to expose masonry surface.

Tile Installation:
- **follow ANSI A108.5 for dry-set mortar, and latex-portland cement mortar.**

Tile-Setting Epoxy and Epoxy Adhesive

Suitable Backings:
- generally all sound wall and floor finishes.
- especially valuable for setting tile floors over non-masonry surfaces where moderate performance level is required.
- suitable for speedy installation where down time must be kept to a minimum.

Requirements:
- backing surface must be sound, clean and dry.
- maximum permissible variation in floor surfaces, 1/8" in 10'-0"; in wall surfaces, 1/8" in 8'-0" from the required plane.

Preparation:
- roughen surfaces which are glossy, painted or effloresced, or which have loose surface material, by sanding or scarifying.
- clean thoroughly to remove all waxes, oil, dirt and dust.
- with epoxy adhesives, use primer when recommended by the manufacturer as proper for the particular backing.

Tile Installation:
- follow ANSI A108.6 for tile-setting epoxy, and manufacturer's specifications for epoxy adhesive.
- epoxy formulations vary with respect to chemical resistance and use on vertical surfaces. Consult manufacturer's specifications.

JOB SHEET #8

II. Tools and materials

A. Tools

1. Steel square
2. Coarse sandpaper
3. Notched trowel (proper notched trowel for type of tile)
4. Beating block
5. Rubber mallet or hammer
6. Sponges
7. Wall- and floor-type rubber grouting trowels
8. Tile cutter
9. Tile saw
10. Nippers
11. Rub brick (stone)
12. Joint striking tool
13. Pails (4 qt, 8 qt, 5 gal)
14. Soft terry cloth towels
15. Rod saw
16. Screwdriver
17. Gauging trowel
18. Margin trowel

B. Materials

1. Epoxy or modified emulsion mortar or Type I or epoxy adhesive
2. Source of clean, potable water
3. Tile and trim (amount and type estimated to complete job)
4. Grout
5. Latex additive for grout

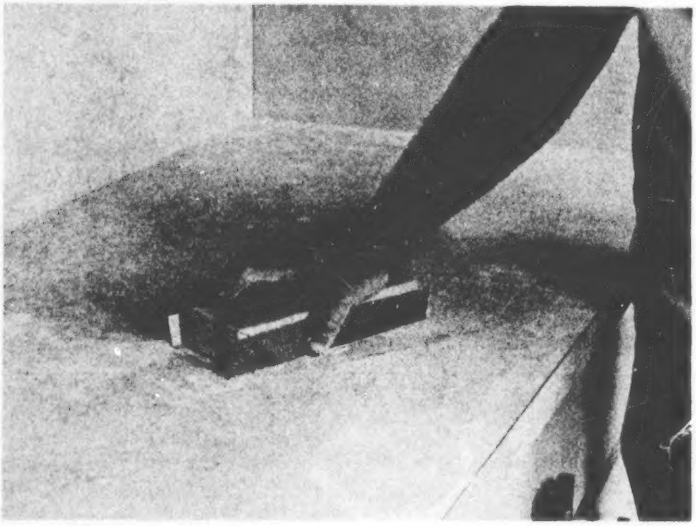
JOB SHEET #8

III. Procedure for layout

A. Remove any metal trim on counter top and backsplash

B. Heavily sand laminate backsplash and counter surface with coarse sandpaper; dust thoroughly (Figure 32)

FIGURE 32



C. Select front edge trim

(NOTE: Some styles of tile do not have V-cap trim. If not, use a bullnose cap.)

D. Lay out tile

IV. Procedure for installing counter top and backsplash

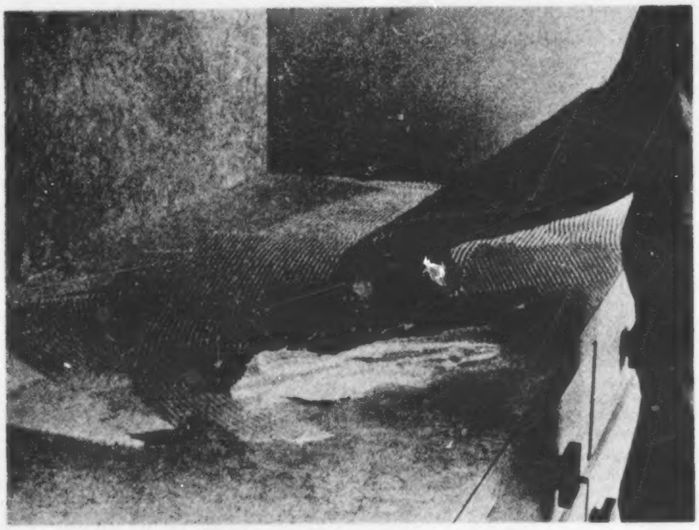
(NOTE: Many tile setters prefer to install tile on the backsplash first to avoid working over the freshly tiled deck. Others prefer to tile the deck first. The first procedure is described in Section B, Unit III. This job sheet discusses the procedure to install the deck tile first.)

A. Mix setting material if required, following manufacturer's directions

JOB SHEET #8

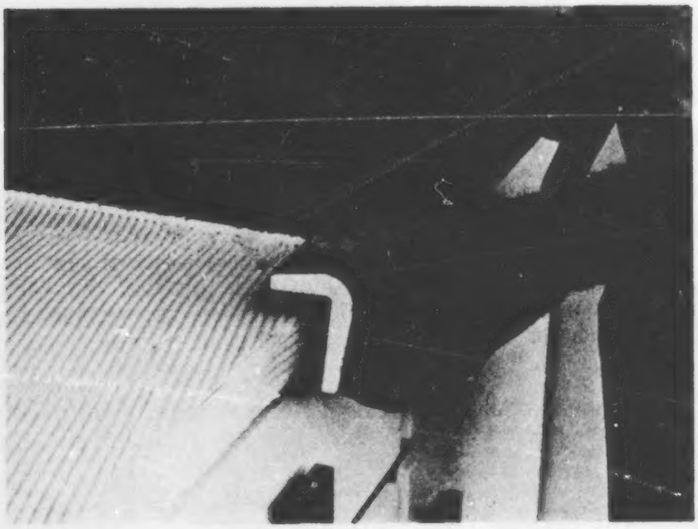
B. Apply adhesive to backsplash with flat side of V-notched trowel; comb with notched edge of trowel to get an even setting bed (Figure 33)

FIGURE 33



C. Start at starting line; press and twist tiles firmly into adhesive, maintaining uniform joint spacing and straight joint lines (Figure 34)

FIGURE 34

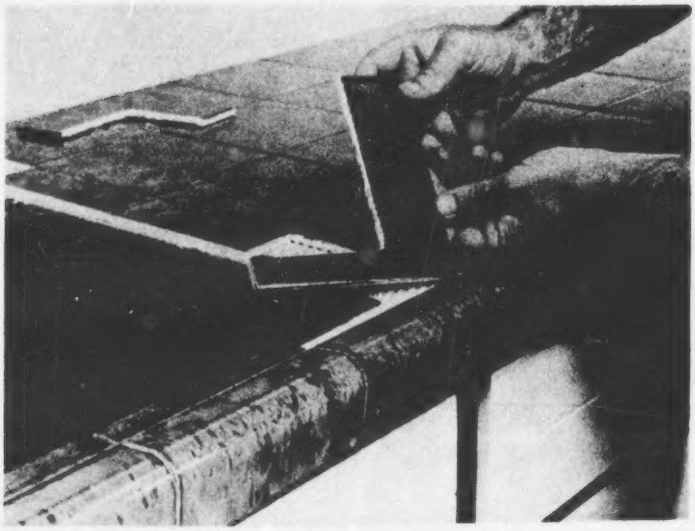


JOB SHEET #8

D. Use a damp sponge to clean adhesive smudges from tile surfaces before beginning next area

E. Make cuts as required with nippers or rod saw; smooth edges with rub brick (Figure 35)

FIGURE 35



F. Complete installation of backsplash tile and trim pieces

G. Install trim

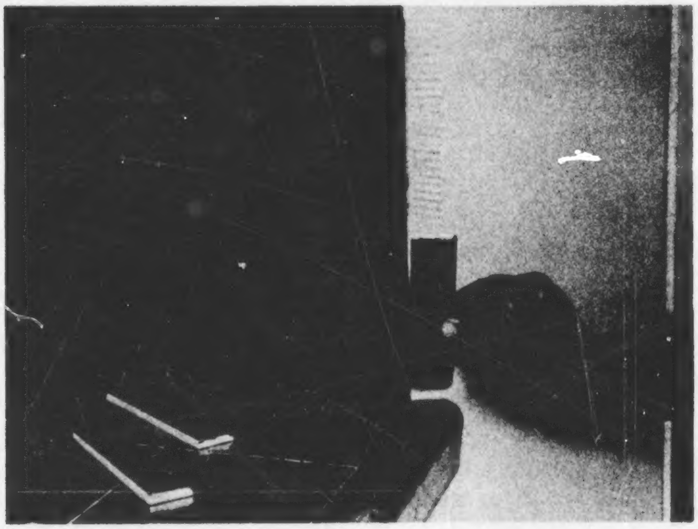
H. Apply adhesive to counter top with flat side of V-notched trowel; comb with notched edge of trowel to get an even setting bed

I. Press and twist tiles firmly into place, matching grout joints with those on trim

JOB SHEET #8

J. Finish edges of backsplash with trim, making sure that trim pieces which meet counter top are cut with rod saw or nippers to fit top contour (Figure 36)

FIGURE 36



K. Remove any excess adhesive from adjacent tiles or wall surface with sponge dipped in five-gallon pail of clean water and wrung out damp

L. Clean tools and work area; barricade and allow to cure for at least twenty-four hours before grouting

V. Procedure for grouting

A. Mix commercial portland cement grout (with latex additive) or mix epoxy grout following manufacturers' directions

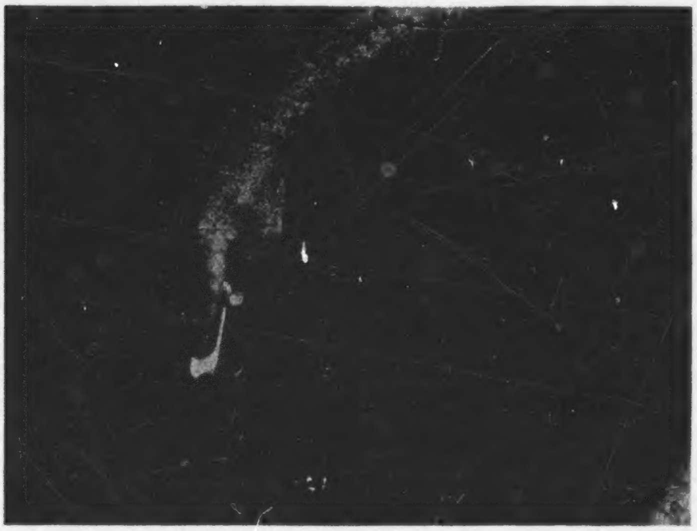
(CAUTION: Use rubber gloves if working with epoxy.)

B. Grout counter top and backsplash, pressing grout into joints and cleaning excess grout from tile surfaces with floor-type rubber grouting trowel

JOB SHEET #8

C. If tile has been installed with wide joints, drag with terry cloth towel; if tile has been installed with narrow joints, clean excess grout from surface with damp sponge and strike joints with striking tool to make them dense, smooth, and uniform (Figure 37)

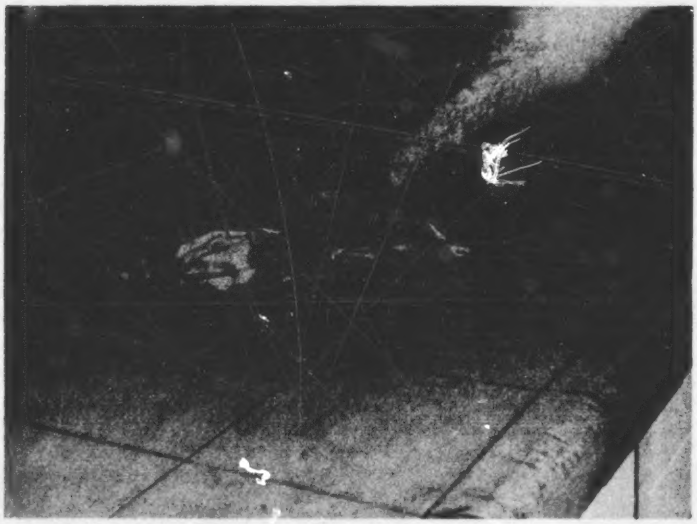
FIGURE 37



D. Clean tile surfaces with sponge dipped in five-gallon pail of clear water and wrung out damp

E. Clean off haze with clean, soft, terry cloth and allow grout to cure for at least forty-eight hours (Figure 38)

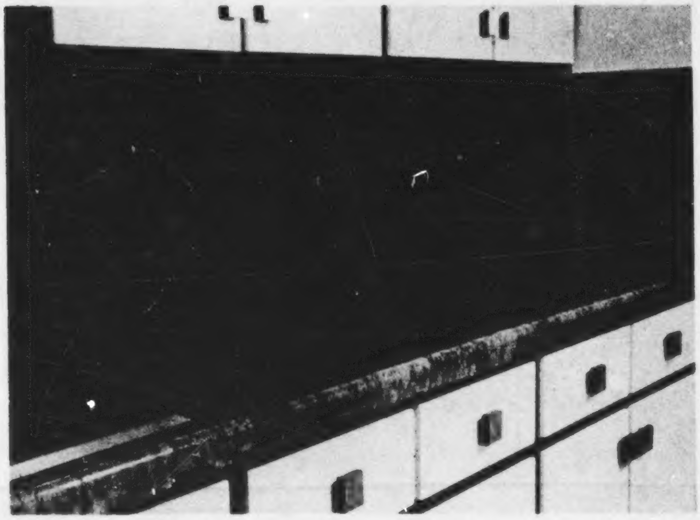
FIGURE 38



JOB SHEET #8

F. Clean tools and leave work area clean and free of waste or debris (Figure 39)

FIGURE 39



Figures 32-39 courtesy of American Olean Tile Company.

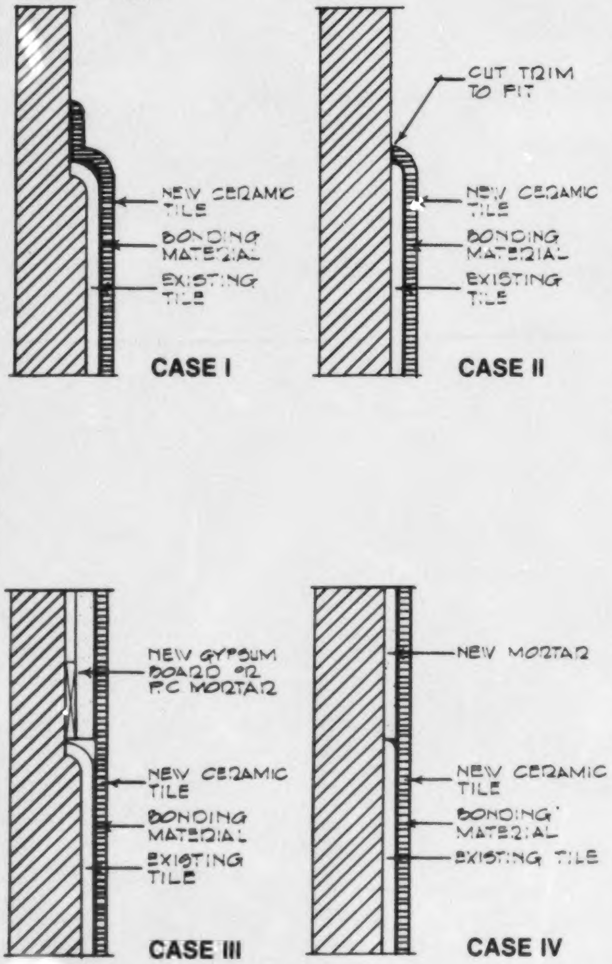
RENOVATION AND REPAIR
UNIT V

JOB SHEET #9 — INSTALL CERAMIC TILE OVER CERAMIC TILE ON TUB SURROUND

I. Detail and guidelines from TCA *Handbook* (Figure 40)

FIGURE 40

Interior Walls


CUT TRIM TO FIT
NEW CERAMIC TILE
BONDING MATERIAL
EXISTING TILE
CASE I
NEW CERAMIC TILE
BONDING MATERIAL
EXISTING TILE
CASE II
NEW GYPSUM BOARD OR P.C MORTAR
NEW CERAMIC TILE
BONDING MATERIAL
EXISTING TILE
CASE III
NEW MORTAR
NEW CERAMIC TILE
BONDING MATERIAL
EXISTING TILE
CASE IV

Recommended Uses:

- for alteration of ceramic-tiled areas where modernization or a change of design is desired in residences, motels and hotels, restaurants, public rest rooms, etc.
- also applicable to smooth walls of marble, stone, slate, etc.

Requirements:

- existing installation must be sound, well bonded, and without major structural cracks.

Materials, Grouting, Expansion Joints, Installation Specifications:

- for organic adhesive installation see Method W223.
- for Dry-Set or latex-portland cement mortar installation see Method W213.
- for epoxy adhesive installation refer to manufacturer's literature.

Preparation:

- remove soap scum, wax, coatings, oil, etc. from existing tile surfaces. Mechanical abrasion with a Carborundum disk followed by a clear water wash is recommended. Other cleaning methods involve use of soapless detergents, commercial tile cleaners, and, in special cases, solvents or acid. Solvents and acids should be used with care and only when necessary because of their hazardous nature.
- installation must be thoroughly rinsed and dry before setting the new tile.
- CASE I — prepare wall above tile to receive trim tile as shown.
- CASE II — cut trim tile to fit over existing trim.
- CASES III & IV — apply new gypsum board above existing wainscot tile to prepare for full wall tiling.

Use portland cement mortar, water-resistant gypsum backing board or glass mesh mortar units in tub enclosures and shower stalls.

In wet areas the application of water-resistant gypsum backer board over any base which causes a vapor barrier to exist, such as old tile or paint shown in Cases III and IV will lead to failure unless such barrier is vented.

NOTE: If installation is not sound. Methods W221 and W222 may be applicable.

JOB SHEET #9

A. Tools

1. Nippers
2. Rod saw
3. Margin trowel
4. Rub brick (stone)
5. Rubber grouting trowel
6. V-notched trowel (proper notched trowel for type of tile)
7. Pails
8. Gauging trowel
9. Steel measuring tape or wood folding rule
10. Clean terry cloth towel
11. Sponges
12. Chisel
13. Claw hammer
14. Tile cutter
15. Razor blade knife
16. Grout saw

B. Materials

1. Tile
2. Trim
3. Dry-set mortar
4. Dry-set grout
5. Type I organic adhesive
6. Latex additive
7. Clean, potable water

JOB SHEET #9

8. Commercial stripper
9. Cleansing powder
10. Spacers

III. Procedure for preparing field

A. Clean existing wall

1. Remove shower head, handles, and escutcheons from all fixtures
2. Use commercial stripper to clean walls of grease and soap scum

(NOTE: Mechanical abrasion with a silicon carbide disk followed by a clear water wash is also recommended.)

3. Clean tiles with cleansing powder; rinse several times with clear water
4. Use a chisel to remove existing soap dish and setting material behind it
5. Use a grout saw to remove grout between tile and tub

B. Lay out tile

IV. Procedure for installing tile

A. With flat side of V-notched trowel, spread organic adhesive up from tub and away from vertical joint, leaving joint visible at all times; comb with notched side of trowel to get an even setting bed

B. Press and twist first row of tiles firmly into place, placing spacers at tub under this row of tiles to leave room for sealant

C. Install second row, leaving out two tiles for soap dish; clean all adhesive from this space

D. Continue installing field until you reach pipe outlets on end walls; make cuts around pipes with rod saw or nippers

(NOTE: Make cuts so that tiles fit as close to the pipes as possible.)

E. Complete installation, cleaning excess adhesive from tile surfaces as you go with sponge dipped in five-gallon pail of clean water and wrung out damp

V. Procedure for installing trim

A. Determine back wall cuts and make on tile cutter, making cuts equal at both side walls

JOB SHEET #9

B. Butter and install pieces of conventional mortar cap (A-cap) on back wall

C. Using margin trowel, butter down angle caps with organic adhesive and press firmly into place at top outside angles of end walls

D. Butter and install pieces of A-cap from down angles toward back wall, leaving a 1/16" joint between each for grout

(NOTE: When you install the first pieces of A-cap, make sure that you do not move the down angle out of place. Grout space must be left between each piece because unlike some tiles, caps and angles do not have lugs.)

E. Cut last piece of cap if necessary; shape with rod saw or nippers to fit curve of back wall cap

F. Butter and install pieces of A-cap from down angle toward floor, leaving 1/16" joints

G. Cut last piece of trim if necessary; smooth with rub brick, butter, and press firmly into place, cut edge toward floor

H. Carefully remove excess organic adhesive from tile surfaces with damp sponge

I. Clean tools, remove all waste from premises, and allow tiled area to cure for at least forty-eight hours before grouting

VI. Procedure for grouting

A. Mix latex additive in clean pail according to manufacturer's directions

B. Stirring vigorously with margin trowel, add small amounts of dry-set grout

C. Mix well until mixture reaches a smooth, no-slump consistency

D. Let stand for fifteen minutes

E. Remix

(CAUTION: Do not add additional powder or liquid.)

F. Transfer small amount of grout to tub surround with rubber grouting trowel

G. Force grout firmly into tile joints, using pressure on grouting trowel and moving in several directions to make sure that joints are well filled

H. Clean excess grout from tiled surfaces with rubber grouting trowel; strike narrow joints

JOB SHEET #9

I. Clean tiled surfaces with sponge dipped in five-gallon pail of clean water and wrung out damp

J. Remove grout from joint between tile and tub

K. Remove grout from space left for soap dish

L. Remove haze by polishing with clean, dry cloths

M. Make holes in space left for soap dish, using electric drill or chisel

N. Butter back and flange for soap dish with fixture adhesive or latex-portland cement mortar or grout; press firmly into place for five or ten seconds

O. Clean excess mortar or adhesive from around dish with a damp sponge

P. Grout around dish and secure with masking tape

Q. Fill joint between tub and tile with elastomeric sealant

(NOTE: Sealant comes in a flexible tube. Cut off the end with a razor-blade knife, making the opening small at first and widening as necessary. Smooth sealant joint as recommended by manufacturer.)

R. Clean tools, remove all waste from premises, and allow tiled area to cure for at least forty-eight hours

RENOVATION AND REPAIR
UNIT V

JOB SHEET #10 — INSTALL CERAMIC TILE OVER EXISTING FLOOR COVERING

I. Guidelines from TCA *Handbook* (Figure 41)

FIGURE 41

Organic Adhesive

Suitable Backings:

- smooth walls of all types including plaster, gypsum board, and masonry.
- smooth floors of all types including wood, concrete and terrazzo in residences or areas of equivalent light performance requirements (see Pages 8 and 9). Deflection not to exceed 1/360 of span.
- new gypsum board nailed and/or adhesively applied over existing walls.
- plastic laminate counter tops & walls.

Requirements:

- the backing surface must be sound, clean and dry.
- max. variation in backing surface shall not exceed 1/8" in 8'-0" from the required plane.
- abrupt irregularities such as trowel marks, ridges and grains shall be less than 1/32" above adjacent area.

Preparation:

- roughen surfaces which are glossy, painted or which have loose surface material by sanding or scarifying.
- surface material must be removed if noncompatible with adhesive.
- use primer when recommended by the adhesive manufacturer as proper for the particular backing.
- clean thoroughly to remove all oil, dirt and dust.
- apply underlayment as needed according to manufacturer's directions.

Tile Installation:

- follow ANSI A108.4.

Dry-Set or Latex-Portland Cement Mortar

Suitable Backings:

- prepared portland cement plaster, concrete, concrete masonry, structural clay tile or brick.
- glass mesh mortar units applied over existing walls or floors.
- new gypsum board nailed and/or adhesively applied over properly furred existing wall in dry areas. Use water-resistant gypsum backer board in wet areas.

Requirements:

- the backing surface must be sound, clean and dry.
- maximum permissible variation in floor surfaces, 1/8" in 10'-0"; in wall surfaces 1/8" in 8'-0" from the required plane.

Preparation:

- roughen concrete or masonry walls and floors which are glossy, painted or effloresced, or which have loose surface material. This should be accomplished by sandblasting, chipping or scarifying.
- clean thoroughly to remove all sealers, coatings, oil, dirt and dust to expose masonry surface.

Tile Installation:

- follow ANSI A108.5 for Dry-Set mortar, and latex-portland cement mortar.

Tile-Setting Epoxy and Epoxy Adhesive

Suitable Backings:

- generally all sound wall and floor finishes.
- especially valuable for setting tile floors over non-masonry surfaces where moderate performance level is required.
- suitable for speedy installation where down time must be kept to a minimum.

Requirements:

- backing surface must be sound, clean and dry.
- maximum permissible variation in floor surfaces, 1/8" in 10'-0"; in wall surfaces, 1/8" in 8'-0" from the required plane.

Preparation:

- roughen surfaces which are glossy, painted or effloresced, or which have loose surface material, by sanding or scarifying.
- clean thoroughly to remove all waxes, oil, dirt and dust.
- with epoxy adhesives, use primer when recommended by the manufacturer as proper for the particular backing.

Tile Installation:

- follow ANSI A108.6 for tile-setting epoxy, and manufacturer's specifications for epoxy adhesive.
- epoxy formulations vary with respect to chemical resistance and use on vertical surfaces. Consult manufacturer's specifications.

JOB SHEET #10

II. Tools and materials

A. Tools

1. Nippers
2. Rub brick (stone)
3. Chalk line
4. Rubber grouting trowel
5. Beating block
6. Claw hammer
7. Kneeling boards
8. Square-notched trowel (proper notched trowel for type of tile)
9. Pails
10. Rubber gloves
11. Rubber mallet
12. Sponges (good assortment)
13. Straightedges
14. Tile cutter
15. Tile saw
16. Margin trowel
17. Gauging trowel
18. Steel measuring tape or wood folding rule
19. Steel square (2')
20. Pencil
21. Clean terry cloth towel
22. Sander

JOB SHEET #10

23. Mop
24. Vacuum cleaner

B. Materials

1. Epoxy, dry-set, latex-portland cement mortar, or Type I or epoxy adhesive
2. Epoxy grout
3. Tiles
4. Bullnose trim or thresholds, as required
5. Spacers
6. Materials for barricade
7. Source of clean, potable water
8. Sandpaper

III. Procedure to prepare floor for installation

A. Inspect tile to be tiled

1. Check to see that existing covering has no loose places; repair as required
2. Check for holes and uneven places

   (NOTE: Maximum variation allowed in floor surfaces renovated with epoxy is 1/8" in 10'-0".)

3. Fill holes and depressions which exceed maximum variation limit with latex-portland cement mortar
4. Let cure overnight if thickness of patch is more than 1/8" thick
5. Mechanically remove grease or wax from floor if necessary
6. Rough surface to be tiled with sandpaper
7. Vacuum sand or damp mop floor

B. Lay out floor installation

C. Double-check measurements and calculations

JOB SHEET #10

D. Get owner approval for layout, if possible

IV. Procedure for installation

A. Put on rubber gloves

(CAUTION: Always wear rubber gloves when working with epoxy materials.)

(NOTE: Epoxy mortar is the recommended bond coat for tile installation over existing floors because of its suitability for so many materials. Refer to ANSI specifications and TCA guidelines for other acceptable mortars.)

B. Mix epoxy mortar

(CAUTION: Be sure epoxy materials have been stored within the proper temperature range before use. Refer to manufacturer's directions and ANSI specifications.)

(CAUTION: Before mixing any mortar, be sure that the proper notched trowel is available.)

1. Follow manufacturer's directions carefully

2. Do not mix more mortar than you will be able to use for the job

   (CAUTION: Temperature affects open time. Bond coat must be plastic at time of installation. Remove and replace epoxy that has filmed over.)

C. Plan installation so that tile may be installed without working over freshly-tiled areas

(NOTE: If it is necessary to work over freshly-tiled areas, use kneeling boards.)

D. Spread mortar in first grid and install tile, making cuts as required

E. Butt tiles against straightedge, as desired

F. Use spacers to maintain joints, as desired

(NOTE: Remove spacers prior to grouting.)

G. Press, twist, and beat each tile into place with beating block and hammer

(CAUTION: Minimum thicknesses of epoxy bond coats after beat-in are $^{1}/_{16}$" for mosaic tiles and $^{1}/_{8}$" for other tiles. Bond coats should completely cover substrate. Coverage after beat-in should be 100 percent for mosaic tile and at least 80 percent for other tiles.)

JOB SHEET #10

H. Clean tiled surfaces with a clean, damp sponge as you go

(CAUTION: Do not allow epoxy to harden on the face of tile.)

I. Continue tile installation to permit completion of job at an exit

J. Install bullnose trim or thresholds as required

K. Allow epoxy to set for at least 16 hours before grouting

L. Grout tile

   1. Follow manufacturer's recommendations for mixing and using grout

   2. Force epoxy into joints using a hard rubber grouting trowel

      (CAUTION: Joints must be completely filled without air pockets or voids.)

   3. Remove excess grout as you complete each section

   4. Finish joints as required for joint width and edge-design of tiles

      (CAUTION: Do not allow epoxy or epoxy film to harden on face of tile.)

   5. Polish tile if haze appears as grout dries

M. Clean up tools and work area; remove all waste

N. Barricade area from traffic

O. Allow installation to cure for at least seventy-two hours

(CAUTION: Epoxy installations should remain at a relatively even temperature during the first eight hours of cure. Do not expose tile to sunlight during the first eight hours of cure.)

RENOVATION AND REPAIR
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Define the following terms associated with completing ceramic tile renovations or repairs.

   a. Escutcheon — ______________________________
   ____
   ____

   b. Renovate — ______________________________
   ____
   ____

   c. Repair — ______________________________
   ____
   ____

   d. Scarify — ______________________________
   ____
   ____

   e. Screed — ______________________________
   ____
   ____

   f. Shoe base — ______________________________
   ____
   ____

   g. Weep holes — ______________________________
   ____
   ____

   h. A-cap — ______________________________
   ____
   ____

TEST

2. State five questions that must be considered before renovating or repairing ceramic tile.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

3. Name three types of repair jobs performed by tile setter.

a. ______________________________

b. ______________________________

c. ______________________________

4. State guidelines for performing repair jobs.

a. ______________________________

____

b. ______________________________

____

5. Select from the following list reasons for replacing grout. Write an "X" in the blank before each correct answer.

_____a. Tile was not grouted correctly during original installation

_____b. Grout cured firm and dense

_____c. Grout was mixed with too much water

_____d. Grout is not clean

_____e. Grout was not cured properly during original installation

_____f. Wall has shifted, causing grout to crack and/or crumble

_____g. Grout was applied too thickly during original installation

_____h. Grout has been cleaned with inappropriate cleaners

TEST

6. Select from the following list guidelines for installing tile over existing floor. Write an "X" in the blank before each correct answer.

______a. Make certain that floor covering is sound and firmly bonded

______b. Use mastic, furan mortar, or epoxy adhesive if tile installation is over wood, plywood, or concrete floor in a wet area

______c. Wet floor thoroughly if it is wooden

______d. Use epoxy mortar, organic adhesive, or latex-portland cement mortar if tile installation is over plywood or concrete in a dry area

______e. Use threshold or bullnose to overcome differences in floor levels with adjoining rooms

______f. Use epoxy mortar or modified epoxy emulsion mortar on tile installations over resilient floor in dry area

______g. Clean floor thoroughly

______h. Use S-cap to overcome differences in floor levels with adjoining rooms

______i. Use underlayment if necessary

7. Select from the following list guidelines for installing ceramic tile over ceramic tile on walls or floor. Write an "X" in the blank before each correct answer.

______a. Clean and buff old tiles to smooth surfaces

______b. Be sure that all old tiles are secure

______c. Be sure that existing tile is completely free of soap residue, wax, grease, and dirt

______d. Remove all trim pieces

______e. Use organic adhesive, epoxy or dry-set mortar, or latex-portland cement mortar as the bonding material in dry areas; follow manufacturer's directions

______f. Remove any broken or cracked tiles and fill in with cement

______g. Lay out field as for new tile installation

______h. Check doors to see if they must be cut

______i. Score all old tile for better bond

TEST

_____j. When preparing for floor installation, remove shoe base or quarter-round if applicable

_____k. Remove doors before tiling

_____l. Complete job as if for new tile installation

_____m. Remove door moldings

_____n. Make sure that field is balanced and opposing cuts are equal

_____o. Make sure there are no small cuts if possible

_____p. Use Type I organic adhesive, dry-set mortar, or latex-portland cement mortar as bonding material in wet areas; follow manufacturer's directions

_____q. If doors must be cut, scribe door where it is to be cut off

_____r. Use S-cap over existing tile

_____s. Use A-cap over existing tile

(NOTE: Test questions 8-10 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

8. Interpret ANSI specifications and TCA guidelines used in renovating and repairing tile installations.

9. Interpret labels of products used in renovating and repairing tile installations.

10. Demonstrate the ability to

    a. Replace loose or damaged tile.

    b. Replace damaged bathroom accessories.

    c. Replace grout.

    d. Clean aged tile.

    e. Remove and replace shower floor and base.

    f. Remove and replace existing backing materials in wet area.

    g. Remove and replace backing materials in a dry area.

    h. Install ceramic tile over laminated counter top and backsplash.

    i. Install ceramic tile over ceramic tile on tub surround.

    j. Install ceramic tile over existing floor covering.

RENOVATION AND REPAIR
UNIT V

ANSWERS TO TEST

1. a. Covering around hot and cold water controls and shower pipe

   b. To clean and replace worn and broken parts in an effort to make fresh or sound again; to make as though new

   c. To put back in good condition after damage and/or decay

   d. To make a series of small superficial cuts or abrasions in a surface

   e. Strip of wood, metal, mortar, or other material applied to a surface; used as a guide on which a straightedge is worked to obtain a true mortar surface

   f. Wood or vinyl floor trim

   g. Slots or holes in drain that enable water to pass through; prevent water from pooling or standing around drain

   h. Trim piece with ¾" radius

2. Answer should include any five of the following

   a. Are the backing materials for a wet or dry area?

   b. Is the new tile to be installed in a wet or dry area?

   c. What is the existing covering?

   d. Must new backing materials be added?

   e. Can type and color of existing tile be matched?

   f. Must existing coverings be removed? If so, how much?

   g. Can ceramic tile be installed over laminated tops?

   h. Can ceramic tile be installed over existing floor coverings?

   i. Will thresholds be needed?

   j. Can ceramic tile be installed over existing ceramic tile?

   k. What preparation must be made by other trades?

   l. What caused the need for repair or renovation?

ANSWERS TO TEST

3. Answer should include any three of the following
   a. Replacing cracked or chipped tile
   b. Replacing tile over water-damaged backing
   c. Replacing damaged bathroom accessories
   d. Cleaning aged tile installations
   e. Replacing shower floor and base
   f. Replacing grout
4. a. Inspect job carefully to estimate extent of damage and materials needed
   b. Recommend future care procedures to customer when job is complete
5. a, c, e, f, h
6. a, d, e, f, g, i
7. b, c, e, g, h, j, k, l, n, o, p, q, s
8. Evaluated to the satisfaction of the instructor
9. Evaluated to the satisfaction of the instructor
10. Performance skills evaluated to the satisfaction of the instructor